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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10' to 50', and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65' swept forebody serrations tended to roll together, while vortices from 40' swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

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7. Abstract
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 345)

APRIL 4, 1997

01 AERONAUTICS

19970010461 Missouri Univ., Cloud and Aerosol Sciences Lab., Rolla, MO USA
The Efficiency of the Smoke Meter at Characterizing Engine Emissions ***Final Report***
Paladino, Jonathan D., Missouri Univ., USA; Jan. 1997; 11p; In English
Contract(s)/Grant(s): NCC3-343; RTOP 538-08-12
Report No.(s): NASA-CR-202317; NAS 1.26:202317; E-10621; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effectiveness of a smoke meter's ability to characterize the particulate emissions of a jet fuel combustor was evaluated using the University of Missouri-Rolla Mobile Aerosol Sampling System (UMR-MASS). A burner simulating an advanced jet engine combustor design was used to generate typical combustion particulates, which were then analyzed by the smoke meter. The same particulates were then size discriminated to ascertain the effective impact of aerosol diameter on smoke number readings.
Author
Smoke; Jet Engine Fuels; Exhaust Emission

19970010469 NASA Langley Research Center, Hampton, VA USA
Calibration of NASA Turbulent Air Motion Measurement System
Barrick, John D. W., NASA Langley Research Center, USA; Ritter, John A., NASA Langley Research Center, USA; Watson, Catherine E., NASA Langley Research Center, USA; Wynkoop, Mark W., NASA Langley Research Center, USA; Quinn, John K., NASA Langley Research Center, USA; Norfolk, Daniel R., NASA Langley Research Center, USA; Dec. 1996; 32p; In English
Contract(s)/Grant(s): RTOP 464-54-13-70
Report No.(s): NASA-TP-3610; NAS 1.60:3610; L-17528; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A turbulent air motion measurement system (TAMMS) was integrated onboard the Lockheed 188 Electra airplane (designated NASA 429) based at the Wallops Flight Facility in support of the NASA role in global tropospheric research. The system provides air motion and turbulence measurements from an airborne platform which is capable of sampling tropospheric and planetary boundary-layer conditions. TAMMS consists of a gust probe with free-rotating vanes mounted on a 3.7-m epoxy-graphite composite nose boom, a high-resolution inertial navigation system (INS), and data acquisition system. A variation of the tower flyby method augmented with radar tracking was implemented for the calibration of static pressure position error and air temperature probe. Additional flight calibration maneuvers were performed remote from the tower in homogeneous atmospheric conditions. System hardware and instrumentation are described and the calibration procedures discussed. Calibration and flight results are presented to illustrate the overall ability of the system to determine the three-component ambient wind fields during straight and level flight conditions.
Author
Air Flow; Flow Measurement; Flying Platforms; Turbulent Flow; Wind Velocity; Wind Measurement; Troposphere

19970010481 Aeronautical Research Inst. of Sweden, Bromma Sweden
Battle Damage Repair: Verification of a 2D Complex Potential Formulation for Determination of Load Transfer in a Bolted Patch Repair of a Fighter Aircraft Wing Structure
Segerfroejd, Gabriel, Aeronautical Research Inst. of Sweden, Sweden; Apr. 1996; 43p; In English
Report No.(s): FFA-TN-1996-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The finite element verification of the two dimensional complex potential (CP) software developed for bolted patch repairs, and the assessment of fastener models, are reported on. In the CP model, fasteners are modeled as point forces with a possibility

of invoking fastener flexibility, whereas in the finite element model, fasteners are represented as rectangular, three dimensional elements with the surface nodes merged to the composite plate and the aluminum patch. The finite element verification analysis is restricted to two dimensions. Results from the CP calculations show conformity with the finite element-calculated fastener reaction forces. The maximum deviation between the two sets of results are observed at the fasteners located the furthest away from the center of the patch.
Author (ESA)
Wing Panels; Aircraft Maintenance; Bolted Joints; Fighter Aircraft; Finite Element Method; Aircraft Structures

19970010624 Akron Univ., Dept. of Electrical Engineering, Akron, OH USA
A Method for Generating Reduced Order Linear Models of Supersonic Inlets ***Final Report***
Chicatelli, Amy, Akron Univ., USA; Hartley, Tom T., Akron Univ., USA; Jan. 1997; 64p; In English
Contract(s)/Grant(s): NAG3-1450; RTOP 509-10-11
Report No.(s): NASA-CR-198538; E-10479; NAS 1.26:198538; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

For the modeling of high speed propulsion systems, there are at least two major categories of models. One is based on computational fluid dynamics (CFD), and the other is based on design and analysis of control systems. CFD is accurate and gives a complete view of the internal flow field, but it typically has many states and runs much slower dm real-time. Models based on control design typically run near real-time but do not always capture the fundamental dynamics. to provide improved control models, methods are needed that are based on CFD techniques but yield models that are small enough for control analysis and design.
Author
Computational Fluid Dynamics; Supersonic Inlets; Computerized Simulation; Matrices (Mathematics); Linear Equations; Linearization

19970011047 NASA Langley Research Center, Hampton, VA USA
Research and Applications in Structures at the NASA Langley Research Center
Abel, Irving, NASA Langley Research Center, USA; Jan. 1997; 28p; In English
Contract(s)/Grant(s): RTOP 522-32-21-01
Report No.(s): NASA-TM-110311; NAS 1.15:110311; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An overview of recently completed programs in structures research at the NASA Langley Research Center is presented. Also included is a description of the unique facilities used to support the structures program. Methods used to perform flutter clearance studies in the wind-tunnel on a high performance fighter are discussed. Recent advances in the use of smart structures and controls to solve the aeroelastic problems of fixed- and rotary-wing vehicles, including flutter, loads, vibrations, and structural response are presented. The use of photogrammetric methods in space to measure spacecraft dynamic response is discussed. The use of advanced analytical methods to speed up detailed structural analysis is presented. Finally, the application of cost-effective composite materials to wing and fuselage primary structures is illustrated.
Author
Aeroelasticity; Smart Structures; Flutter; Dynamic Structural Analysis; Research; Composite Materials; Test Facilities

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19970010380 NASA Langley Research Center, Hampton, VA USA
A Wind Tunnel Investigation of Three NACA 1-Series Inlets at Mach Numbers up to 0.92
Re, Richard J., NASA Langley Research Center, USA; Abeyounis, William K., NASA Langley Research Center, USA; Nov. 1996; 184p; In English
Contract(s)/Grant(s): RTOP 538-13-01
Report No.(s): NASA-TM-110300; NAS 1.15:110300; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Pressure distributions on three NACA 1-series inlets have been obtained in the Langley 16-Foot Transonic Tunnel. The cowl diameter ratio (ratio of cowl highlight diameter to cowl maximum diameter) was 0.85 for all three inlets. The cowl length ratio (ratio of cowl length to cowl maximum diameter) was 1.0 for two of the inlets (NACA 1-85-100) and 0.439 for the other (NACA 1-85-43.9) inlet. One of the inlets with a cowl length ratio of 1.0 had an internal contraction ratio (ratio of highlight area to throat area) of 1.009 and the other had a contraction ratio of 1.250. The inlet with a cowl length ratio of 0.439 also had an internal contraction ratio of 1.250. All three inlets had longitudinal rows of static pressure orifices on the top and bottom external cowl surfaces.

The inlet with a contraction ratio of 1.009 also had a row of static pressure orifices on the side of the cowl (external surface). The two inlets with a contraction ratio of 1.250 had a longitudinal row of static pressure orifices on the diffuser surface.
Author
Wind Tunnel Tests; Pressure Distribution; Static Pressure; Engine Inlets; Aircraft Engines; Mach Number; Angle of Attack; Subsonic Flow

19970010399 Naval Air Warfare Center, Patuxent River, MD USA
Status of a Comprehensive Validation of the Navy's F/A-18A/B/C/D Aerodynamics Model
Bonner, Michael S., Naval Air Warfare Center, USA; Gingras, David R., Naval Air Warfare Center, USA; May 22, 1996; 12p; In English
Report No.(s): AD-A309807; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A flight test program was designed and flown with two U.S. Navy F/A-18 aircraft and the Naval Air Warfare Center Aircraft Division, Patuxent River, MD to collect data for validation of the Manned Flight Simulator's F/A-18 aerodynamics model. This paper details the flight test program and the processes used to calibrate the flight data for the creation of a truth-data set to be used for the validation as well as source for future updates. The paper presents examples of preliminary aerodynamic coefficient comparisons between model predicted values and values extracted from flight. It also provides a discussion of a coefficient comparison acceptance criteria currently being developed.
DTIC
F-18 Aircraft; Flight Tests; Aerodynamic Coefficients; Aerodynamics

19970010462 NYMA, Inc., Brook Park, OH USA
Parallel NPARC: Implementation and Performance ***Final Report***
Townsend, S. E., NYMA, Inc., USA; Dec. 1996; 12p; In English; 35th; Aerospace Sciences Meeting and Exhibit, 6-10 Jan. 1997, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-27186; RTOP 509-10-11
Report No.(s): NASA-CR-202312; NAS 1.26:202312; E-10605; AIAA Paper 97-0026; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Version 3 of the NPARC Navier-Stokes code includes support for large-grain (block level) parallelism using explicit message passing between a heterogeneous collection of computers. This capability has the potential for significant performance gains, depending upon the block data distribution. The parallel implementation uses a master/worker arrangement of processes. The master process assigns blocks to workers, controls worker actions, and provides remote file access for the workers. The processes communicate via explicit message passing using an interface library which provides portability to a number of message passing libraries, such as PVM (Parallel Virtual Machine). A Bourne shell script is used to simplify the task of selecting hosts, starting processes, retrieving remote files, and terminating a computation. This script also provides a simple form of fault tolerance. An analysis of the computational performance of NPARC is presented, using data sets from an F/A-18 inlet study and a Rocket Based Combined Cycle Engine analysis. Parallel speedup and overall computational efficiency were obtained for various NPARC run parameters on a cluster of IBM RS6000 workstations. The data show that although NPARC performance compares favorably with the estimated potential parallelism, typical data sets used with previous versions of NPARC will often need to be reblocked for optimum parallel performance. In one of the cases studied, reblocking increased peak parallel speedup from 3.2 to 11.8.
Author
Parallel Processing (Computers); Parallel Computers; Navier-Stokes Equation; Fault Tolerance; Computational Fluid Dynamics

19970010470 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA
Effect of Surface Waviness on Transition in Three-Dimensional Boundary-Layer Flow
Masad, Jamal A., Lockheed Martin Engineering and Sciences Co., USA; Dec. 1996; 44p; In English
Contract(s)/Grant(s): NAS1-96014; RTOP 538-05-15-01
Report No.(s): NASA-CR-201641; NAS 1.26:201641; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effect of a surface wave on transition in three-dimensional boundary-layer flow over an infinite swept wing was studied. The mean flow computed using interacting boundary-layer theory, and transition was predicted using linear stability theory coupled with the empirical eN method. It was found that decreasing the wave height, sweep angle, or freestream unit Reynolds

number, and increasing the freestream Mach number or suction level all stabilized the flow and moved transition onset to downstream locations.
Author
Three Dimensional Flow; Three Dimensional Boundary Layer; Boundary Layer Transition; Boundary Layer Flow; Free Flow; Transition Flow; Surface Waves

19970010645 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
Aerodynamic design optimization via reduced Hessian SQP with solution refining
Feng, Dan, Research Inst. for Advanced Computer Science, USA; Pulliam, Thomas H., NASA Ames Research Center, USA; Dec. 1995; 22p; In English
Contract(s)/Grant(s): NAS2-13721
Report No.(s): NASA-CR-203261; NAS 1.26:203261; RIACS-TR-95-24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An all-at-once reduced Hessian Successive Quadratic Programming (SQP) scheme has been shown to be efficient for solving aerodynamic design optimization problems with a moderate number of design variables. This paper extends this scheme to allow solution refining. In particular, we introduce a reduced Hessian refining technique that is critical for making a smooth transition of the Hessian information from coarse grids to fine grids. Test results on a nozzle design using quasi-one-dimensional Euler equations show that through solution refining the efficiency and the robustness of the all-at-once reduced Hessian SQP scheme are significantly improved.
Author
Aerodynamics; Optimization; Nozzle Design; Design Analysis

19970010648 Colorado State Univ., Dept. of Atmospheric Science, Fort Collins, CO USA
Mid-Level Vorticity in Mesoscale Convective Systems
King, Ronnie G., Colorado State Univ., USA; May 08, 1996; 100p; In English
Report No.(s): AD-A311705; AFIT-96-040; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The objective of this study has been to examine and document the development of mid-level Mesoscale Convective Vortices (MCVs) within Mesoscale Convective Systems (MCSs) and Mesoscale Convective Complexes (MCCs) using the Central Plains Wind Profiler Demonstration Network (WPDN). Nine MCSs from the summer of 1993 were picked for this study based on their formation and lifetime spent over the WPDN. Bartels and Maddox's (1991) climatological study of MCVs for 1981 - 1988 estimated that less than 5% of MCSs exhibit a vortex whose clouds persist long enough after the dissipation of the MCSs high-level obscuring cirrus cloud to become apparent in visible satellite imagery. This low estimate of MCVs in MCSs leads to the question of how many MCSs produce MCVs. Some researchers state that the MCV is an inherent part of the MCC circulation (Velasco and Fritsch, 1987; Menard and Fritsch, 1989).
DTIC
Satellite Imagery; Mesoscale Phenomena; Vortices; Convection; Climatology; Cirrus Clouds

19970010662 Wright Lab., Flight Dynamics Directorate, Wright-Patterson AFB, OH USA
Measured AEDC Tunnel B and Predicted Linear Stability Theory Transition Comparison Study for a 7-Degree Sharp Cone ***Final Report, Oct. 1995 - Mar. 1996***
Rougeux, Albert A., Wright Lab., USA; Mar. 1996; 50p; In English
Report No.(s): AD-A310763; WL-TR-96-3069; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The location of the stability region between the laminar and turbulent flow is of great importance in the design of high speed missiles and aircraft. Heat transfer and skin friction vary greatly between laminar and turbulent flow, therefore, transition location is indispensable for predicting vehicle performance. The boundary layer stability of a sharp, 7-degree half angle cone with freestream Mach numbers of 6 and 8 was numerically investigated using a linear stability theory computer program. Results were compared with wind tunnel tests results obtained at the AEDC Von Karman Hypersonic Tunnel B. Measured and computed frequencies agree well, indicating that linear stability theory properly describes the processes leading to transition at the AEDC Tunnel B.
DTIC
Boundary Layer Stability; Slender Cones; Hypersonic Boundary Layer; Boundary Layer Transition

19970010763 Research Inst. for Advanced Computer Science, Moffett Field, CA USA

A Solution Adaptive Structured/Unstructured Overset Grid Flow Solver with Applications to Helicopter Rotor Flows

Duque, Earl P. N., Army Aviation Systems Command, USA; Biswas, Rupak, Research Inst. for Advanced Computer Science, USA; Strawn, Roger C., Army Aviation Systems Command, USA; Apr. 1995; 14p; In English; 13th; Applied Aerodynamics Conference, 19-21 Jun. 1995, San Diego, CA, USA

Contract(s)/Grant(s): NAS2-13721

Report No.(s): NASA-CR-203262; NAS 1.26:203262; RIACS-TR-95-09; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper summarizes a method that solves both the three dimensional thin-layer Navier-Stokes equations and the Euler equations using overset structured and solution adaptive unstructured grids with applications to helicopter rotor flowfields. The overset structured grids use an implicit finite-difference method to solve the thin-layer Navier-Stokes/Euler equations while the unstructured grid uses an explicit finite-volume method to solve the Euler equations. Solutions on a helicopter rotor in hover show the ability to accurately convert the rotor wake. However, isotropic subdivision of the tetrahedral mesh rapidly increases the overall problem size.

Author

Computational Grids; Structured Grids (Mathematics); Unstructured Grids (Mathematics); Navier-Stokes Equation; Rotary Wings; Finite Volume Method; Finite Difference Theory; Computational Fluid Dynamics; Computerized Simulation

19970010813 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA USA

On Approximate Factorization Schemes for Solving the Full Potential Equation

Holst, Terry L., National Aeronautics and Space Administration. Ames Research Center, USA; Feb. 1997; 40p; In English

Contract(s)/Grant(s): RTOP 522-31-12

Report No.(s): NASA-TM-110435; NAS 1.15:110435; A-975739; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An approximate factorization scheme based on the AF2 algorithm is presented for solving the three-dimensional full potential equation for the transonic flow about isolated wings. Two spatial discretization variations are presented, one using a hybrid first-order/second-order-accurate scheme and the second using a fully second-order-accurate scheme. The present algorithm utilizes a C-H grid topology to map the flow field about the wing. One version of the AF2 iteration scheme is used on the upper wing surface and another slightly modified version is used on the lower surface. These two algorithm variations are then connected at the wing leading edge using a local iteration technique. The resulting scheme has improved linear stability characteristics and improved time-like damping characteristics relative to previous implementations of the AF2 algorithm. The presentation is highlighted with a grid refinement study and a number of numerical results.

Author

Transonic Flow; Wings; Flow Distribution; Computational Grids; Potential Flow; Computational Fluid Dynamics; Iterative Solution

19970010843 Naval Postgraduate School, Monterey, CA USA

A Water Tunnel Investigation of the Influence of Reynolds Number on the High-Incidence Flow Over Double-Delta Wings

Fritz, Anastasios E., Naval Postgraduate School, USA; Mar. 1996; 202p; In English

Report No.(s): AD-A310282; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

There are several disagreements in the published literature on vortex interaction and bursting data obtained in various wind and water tunnel tests of double-delta wings at high angle of attack (AOA). Therefore a test program was carried out in the Naval Postgraduate School water tunnel using a 76/40 deg. baseline double-delta wing model to investigate the effect of Reynolds number. The program consisted of: (1) Flow visualisation studies at tunnel speeds of O.2, O.6 and 1.0 ft/sec in the 0-30 deg. AOA range to determine the influence of flow Reynolds number on vortex trajectory/interaction and breakdown. (2) Laser Doppler Velocimetry studies of the flowfield to gain a better understanding of the vortex structure and verify the flow visualisation results. Comparison of the test results at these tunnel speeds (corresponding to nominal flow Reynolds number of 15,000, 45,000, and 75,000 indicates a change in the vortical flowfield structure. The strake and wing vortices do not coil up and the breakdown occurs earlier as the tunnel speed is increased.The trends in the interaction and bursting data at higher tunnel speeds appear to be in better agreement with previous wind tunnel data.

DTIC

Angle of Attack; Vortices; Water Tunnel Tests; Wind Tunnel Tests; Reynolds Number; Strakes; Flow Distribution; Laser Doppler Velocimeters; Delta Wings

19970011025 Technische Univ., Faculty of Aerospace Engineering, Delft Netherlands
Inverse 3-D aerodynamic design over the flight envelope
Middel, J., Technische Univ., Netherlands; Apr. 1996; 24p; In English
Report No.(s): LR-803; ISBN-90-5623-037-0; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A tool for the aerodynamic design of complex three dimensional configurations with prescribed surface pressure distributions is presented. One of the most important goals in aerodynamic design is to find an aircraft shape definition which fulfills the optimal operational requirements. The method proposed consists of a procedure to determine amplitudes of local changes of a baseline geometry that yields a best fit through the user prescribed target pressure distributions, considering different flight conditions. This method is based on a three dimensional linear potential flow method and allows the control over where and how the geometry is changed.

Author (ESA)

Aircraft Design; Aerodynamic Characteristics; Panel Method (Fluid Dynamics); Design Analysis; Pressure Distribution; Flight Envelopes; Three Dimensional Flow

19970011043 NASA Ames Research Center, Moffett Field, CA USA
Rotor Vortex Filaments: Living on the Slipstream's Edge
Young, Larry A., NASA Ames Research Center, USA; Jan. 1997; 44p; In English
Contract(s)/Grant(s): RTOP 505-59-36
Report No.(s): NASA-TM-110431; A-975569; NAS 1.15:110431; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this paper is to gain a better understanding of rotor wake evolution in hover and axial flow by deriving an analytical solution for the time dependent behavior of vortex filament circulation and core size. This solution is applicable only for vortex filaments in the rotor far-wake. A primarily inviscid vortex/shear layer interaction (where the slipstream boundary is modeled as a shear layer) has been identified in this analytical treatment. This vortex/shear layer interaction results in decreasing, vortex filament circulation and core size with time. The inviscid vortex/shear layer interaction is shown, in a first-order treatment, to be of greater magnitude than viscous diffusion effects. The rate of contraction, and ultimate collapse, of the vortex filament core is found to be directly proportional to the rotor inflow velocity. This new insight into vortex filament decay promises to help reconcile several disparate observations made in the literature and will, hopefully, promote new advances in theoretical modeling of rotor wakes.

Author

Vortex Filaments; Slipstreams; Shear Layers; Hovering; Axial Flow; Rotary Wing Aircraft; Computational Fluid Dynamics

19970011044 Sterling Software, Inc., Redwood Shores, CA USA
PROFILE: Airfoil Geometry Manipulation and Display, User's Guide
Collins, Leslie, Sterling Software, Inc., USA; Saunders, David, Sterling Software, Inc., USA; Feb. 1997; 102p; In English
Contract(s)/Grant(s): NAS2-13210
Report No.(s): NASA-CR-177332; NAS 126:177332; A-976001; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report provides user information for program PROFILE, an aerodynamics design utility for plotting, tabulating, and manipulating airfoil profiles. A dozen main functions are available. The theory and implementation details for two of the more complex options are also presented. These are the REFINE option, for smoothing curvature in selected regions while retaining or seeking some specified thickness ratio, and the OPTIMIZE option, which seeks a specified curvature distribution. Use of programs QPLOT and BPLOT is also described, since all of the plots provided by PROFILE (airfoil coordinates, curvature distributions, pressure distributions)) are achieved via the general-purpose QPLOT utility. BPLOT illustrates (again, via QPLOT) the shape functions used by two of PROFILE's options. These three utilities should be distributed as one package. They were designed and implemented for the Applied Aerodynamics Branch at NASA Ames Research Center, Moffett Field, California. They are all written in FORTRAN 77 and run on DEC and SGI systems under OpenVMS and IRIX.

Author

Airfoil Profiles; User Manuals (Computer Programs); Applications Programs (Computers); Shape Functions; Aerodynamics

19970011085 National Aeronautics and Space Administration. Langley Research Center, Hampton, VA USA
Direct Numerical Simulation of Evolution and Control of Linear and Nonlinear Disturbances in Three-Dimensional Attachment-Line Boundary Layers
Joslin, Ronald D., National Aeronautics and Space Administration. Langley Research Center, USA; Feb. 1997; 44p; In English
Contract(s)/Grant(s): RTOP 505-59-50-02
Report No.(s): NASA-TP-3623; NAS 1.60:3623; L-17578; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Spatially evolving linear and nonlinear disturbances in a three-dimensional (3D) attachment-line boundary layer are computed by direct numerical simulation of the unsteady, incompressible Navier-Stokes equations. Previously, a weakly nonlinear theory and computation revealed a high wave-number region of subcritical disturbance growth, which is a region where linear theory predicts the decay of small-amplitude disturbances. More recent computations have failed to achieve this subcritical growth. The present computational results duplicate and explain both subcritically growing and decaying disturbances and resolve the previous theoretical and computational discrepancy. The present results demonstrate that steady suction can be used to stabilize disturbances that otherwise grow subcritically along the attachment line. However, true 3D disturbances are more likely in practice. Disturbances generated off (but near) the attachment line are shown to spread both away from and toward the attachment line as they evolve. Furthermore, these disturbances generated near the attachment line can supply energy to attachment-line instabilities, but the results show that suction can be used to stabilize these instabilities. Finally, symmetric and asymmetric disturbance growth predicted by a two-dimensional-eigenvalue approach is demonstrated to agree with the DNS results.
Author
Computerized Simulation; Digital Simulation; Navier-Stokes Equation; Three Dimensional Boundary Layer; Incompressible Flow

19970011188 Boeing Co., Commercial Airplane Group, Seattle, WA USA
Sonic Boom Propagation Codes Validated by Flight Test
Poling, Hugh W., Boeing Co., USA; Oct. 1996; 74p; In English
Contract(s)/Grant(s): NAS1-20220; RTOP 537-07-21
Report No.(s): NASA-CR-201634; NAS 1.26:201634; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The sonic boom propagation codes reviewed in this study, SHOCKN and ZEPHYRUS, implement current theory on air absorption using different computational concepts. Review of the codes with a realistic atmosphere model confirm the agreement of propagation results reported by others for idealized propagation conditions. ZEPHYRUS offers greater flexibility in propagation conditions and is thus preferred for practical aircraft analysis. The ZEPHYRUS code was used to propagate sonic boom waveforms measured approximately 1000 feet away from an SR-71 aircraft flying at Mach 1.25 to 5000 feet away. These extrapolated signatures were compared to measurements at 5000 feet. Pressure values of the significant shocks (bow, canopy, inlet and tail) in the waveforms are consistent between extrapolation and measurement. of particular interest is that four (independent) measurements taken under the aircraft centerline converge to the same extrapolated result despite differences in measurement conditions. Agreement between extrapolated and measured signature duration is prevented by measured duration of the 5000 foot signatures either much longer or shorter than would be expected. The duration anomalies may be due to signature probing not sufficiently parallel to the aircraft flight direction.
Author
Sonic Booms; Wave Propagation; Computer Programs; Atmospheric Models; Sound Propagation; Aerodynamic Noise

19970011223 NASA Langley Research Center, Hampton, VA USA
Serrated-Planform Lifting-Surfaces
McGrath, Brian E., Inventor, NASA Langley Research Center, USA; Wood, Richard M., Inventor, NASA Langley Research Center, USA; Oct. 22, 1996; 38p; In English
Patent Info.: Filed 22 Oct. 1996; NASA-Case-LAR-15295-1; US-Patent-Appl-SN-734820
Report No.(s): NAS 1.71:LAR-15295-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A set of serrated-planform lifting surfaces is provided which produces unexpectedly high lift coefficients at moderate to high angles-of-attack. Each serration, or tooth, is designed to shed a vortex. The interaction of the vortices greatly enhances the lifting capability over an extremely large operating range. Variations of the invention use serrated-planform lifting surfaces in planes different than that of a primary lifting surface. In an alternate embodiment, the individual teeth are controllably retractable and deployable to provide for active control of the vortex system and hence lift coefficient. Differential lift on multiple serrated-planform lifting surfaces provides an means for vehicle control. The important aerodynamic advantages of the serrated-planform lifting surfaces are not limited to aircraft applications but can be used to establish desirable performance characteristics for missiles, land vehicles, and/or watercraft.
NASA
Angle of Attack; Lift; Vortex Shedding; Active Control; Lifting Bodies

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19970010385 NASA Langley Research Center, Hampton, VA USA
A Comparison of Two Control Display Unit Concepts on Flight Management System Training
Abbott, Terence S., NASA Langley Research Center, USA; Jan. 1997; 14p; In English
Contract(s)/Grant(s): RTOP 505-64-53-01
Report No.(s): NASA-TM-4744; NAS 1.15:4744; L-17563; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the biggest challenges for a pilot in the transition to a 'glass' cockpit is understanding the flight management system (FMS). Because of both the complex nature of the FMS and the pilot-FMS interface, a large portion of transition training is devoted to the FMS. The current study examined the impact of the primary pilot-FMS interface, the control display unit (CDU), on FMS training. Based on the hypothesis that the interface design could have a significant impact on training, an FMS simulation with two separate interfaces was developed. One interface was similar to a current-generation design, and the other was a multiwindows CDU based on graphical user interface techniques. For both application and evaluation reasons, constraints were applied to the graphical CDU design to maintain as much similarity as possible with the conventional CDU. This preliminary experiment was conducted to evaluate the interface effects on training. Sixteen pilots with no FMS experience were used in a between-subjects test. A time-compressed, airline-type FMS training environment was simulated. The subjects were trained to a fixed-time criterion, and performance was measured in a final, full-mission simulation context. This paper describes the technical approach, simulation implementation, and experimental results of this effort.
Author
Flight Management Systems; Graphical User Interface; Cockpits; Display Devices

19970010403 Federal Aviation Administration, Washington, DC USA
Aviation Safety Plan
Feb. 1996; 234p; In English; Limited Reproducability: More than 20% of this document may be affected by Microfiche quality
Report No.(s): AD-A308941; No Copyright; Avail: Issuing Activity (US Department of Transportation, Federal Aviation Adminstration, Washington, DC), Microfiche

The purpose of this document is to describe the continuing partnership in the aviation community to improve aviation transportation safety. The document begins by providing some background on this effort and a summary of the Aviation Safety Initiative Review held in New Orleans, Louisiana on December 6 and 7, 1995. The ongoing process proposed by the steering committee for future reviews as well as the next steps required are also described. The core of the document reports on the detailed results of this technical meeting broken out by workshop. These detailed results include: significant accomplishments since the January 1995 meeting; themes, issues, approaches, and initiatives for 1996; significant changes from the 1995 initiatives; identification of the highest priority aviation safety initiatives for 1996; and cross-cutting issues with the other workshops. Two appendices are included. The first provides a list of meeting participants. The second tracks the issues, approaches, and initiatives from the February 1995 Aviation Safety Action Plan to the results of the December 1995 review. This is intended to show the disposition of the 1995 initiatives and how they translated into the 1996 initiatives.
DTIC
Aircraft Safety; Flight Safety

19970010855 Nebraska Univ., Aviation Inst., Omaha, NE USA
The Airline Quality Rating 1996
Bowen, Brent D., Nebraska Univ., USA; Headley, Dean E., Wichita State Univ., USA; Apr. 1996; 47p; In English
Report No.(s): UNOAI-96-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Airline Quality Rating (AQR) was developed and first announced in early 1991 as an objective method of comparing airline performance on combined multiple factors important to consumers. Development history and calculation details for the AQR rating system are detailed in The Airline Quality Rating 1991 issued in April, 1991, by the National Institute for Aviation Research at Wichita State University. This current report, Airline Quality Rating 1996, contains monthly Airline Quality Rating scores for 1995. Additional copies are available by contacting Wichita State University or University of Nebraska at Omaha. The Airline Quality Rating 1996 is a summary of month-by-month quality ratings for the nine major domestic U.S. airlines operating during 1995. Using the Airline Quality Rating system and monthly performance data for each airline for the calendar year of 1995, individual and comparative ratings are reported. This research monograph contains a brief summary of the AQR methodology, detailed data and charts that track comparative quality for major domestic airlines across the 12 month period of 1995, and industry

average results. Also, comparative Airline Quality Rating data for 1991 through 1994 are included to provide a longer term view of quality in the industry.
Author
Airline Operations; Quality Control; Ratings; Civil Aviation; Commercial Aircraft

19970011096 NASA Langley Research Center, Hampton, VA USA
Proceedings of the NASA Workshop on Flight Deck Centered Parallel Runway Approaches in Instrument Meteorological Conditions
Waller, Marvin C., Editor, NASA Langley Research Center, USA; Scanlon, Charles H., Editor, NASA Langley Research Center, USA; Dec. 1996; 208p; In English; Flight Deck Centered Parallel Runway Approaches in Instrument Meteorological Conditions, 29 Oct. 1996, Hampton, VA, USA; original contains color illustrations
Contract(s)/Grant(s): RTOP 538-04-11-17
Report No.(s): NASA-CP-10191; NAS 1.55:10191; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A Government and Industry workshop on Flight-Deck-Centered Parallel Runway Approaches in Instrument Meteorological Conditions (IMC) was conducted October 29, 1996 at the NASA Langley Research Center. This document contains the slides and records of the proceedings of the workshop. The purpose of the workshop was to disclose to the National airspace community the status of ongoing NASA R&D to address the closely spaced parallel runway problem in IMC and to seek advice and input on direction of future work to assure an optimized research approach. The workshop also included a description of a Paired Approach Concept which is being studied at United Airlines for application at the San Francisco International Airport.
Author
Airline Operations; Runways; Conferences; Landing; Air Traffic

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19970010446 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA
Aerospace Applications of Navigation Satellites
Yu, Yao; Liyu, Zhang; Cama, China Astronautics and Missilery Abstracts; May 13, 1996; Volume 2, No. 5, pp. 158-161; Transl. into ENGLISH of Cama, China Astronautics and Missilery Abstracts (China), v2 n5 p158-161, 1994; In English
Report No.(s): AD-A309748; NAIC-ID(RS)T-0254-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The USA Navstar Global Positioning System (Navstar-GPS) and Russia's Global Navigation Satellite System (GloNaSS) are the new-generation global satellite radio navigation systems each developed separately in the 1970s. Their appearance fundamentally changed the concept of global navigation. The GPS satellite system is composed of a constellation of 24 satellites at an altitude of approximately 20,000 kilometers, distributed in orbits at six equivalent intervals. The orbital planes are at 55 degrees relative to the included angle of the equator, and there are four satellites in each orbital plane. The satellites' orbital planes are approximately circular, and their period of revolution is about 11 hours and 58 minutes. This satellite distribution can ensure that anywhere in the world, at any time, at least four satellites are provided for observation. Similarly, the GLONASS system will also deploy 24 satellites. GLONASS satellites are positioned on three orbital planes at intervals of 120 degrees, their orbital altitude is approximately 19,000 kilometers, their orbital inclination is about 65 degrees, and their period of revolution is 12 hours. GPS and GLONASS each have their own individual characteristics and advantages but, as of now, most users' receivers can only receive satellite signals from one of the systems. Development of an integrated receiver that can receive satellite signals from both GPS and GLONASS will certainly raise navigation accuracy by a large margin. GPS a nd GLONASS are two mutually independent systems but, in recent years, integrated use of both systems has become possible. Integrated receivers can either receive GPS or GLONASS signals alone or use a combination of their signals, and can provide more complete navigation service than using only one of the systems can.
DTIC
Aerospace Engineering; Global Positioning System; Navstar Satellites; GLONASS

19970010828 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Design and Analysis of a Navigation System Using the Federated Filter
Delory, Stephen J., Air Force Inst. of Tech., USA; Dec. 1995; 124p; In English
Report No.(s): AD-A309878; AFIT/GSO/ENG/95D-02; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The purpose of this paper was to design and analyse a federated filter design, to be used for retrofit of an Embedded GPS/INS (EGI) navigation unit into an existing Kalman filter-based air navigation system. A design was selected and simulations were conducted in the Distributed Kalman Filter Simulation software (DKFSIM). As well, a centralized Kalman filter design was simulated under identical conditions for comparison purposes. The federated filter was shown to be a feasible design, with accuracy in position and velocity very close to centralized Kalman filter values. The federated filter design also showed some attractive fault detection and isolation features, superior to the centralized Kalman filter, due to the independent operation of the component Kalman filters. The federated filter was shown to be well worthy of continued study for implementation in air navigation systems, especially where distributed filters are required.
DTIC
Air Navigation; Kalman Filters; Global Positioning System; Fault Detection; Computerized Simulation

19970010893 Deutsche Geodaetische Kommission, Frankfurt Germany
Contributions to the Common Adjustment of Terrestrial Position Nets and GPS Compression Nets for the Area of the New Federal States ***Beitraege zur gemeinsamen Ausgleichung von terrestrischen Lagenetzen und GPS-Verdichtungsnetzen fuer das Gebiet der neuen Bundeslaender***
Soltau, G., Deutsche Geodaetische Kommission, Germany; Contributions to the common adjustment of terrestrial position nets and GPS compression nets for the area of the new federal states; Jan. 1995; ISSN 0071-9196; 69p; In German; Also announced as 19970010894 through 19970010895
Report No.(s): Ser-B-302; Mitt-188; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The diagnosis adjustment in the net block 3 of the German primary triangulation network in the system 42/83 is addressed. The available accuracy of terrestrial and global positioning system (GPS) observations is estimated. The computations of coordinates of the first and third order trigonometric network in the reference system, ETRS89, were performed within the net block 3.
Author (ESA)
Global Positioning System; Earth Observations (From Space); Geodetic Coordinates

19970010894 Deutsche Geodaetische Kommission, Frankfurt Germany
The Diagnostic Adjustment in the Net Block 3 of the German Primary Triangulation Network (DHDN 1990) in the System 42/83 ***Die Diagnoseausgleichung im Netzblock 3 des Deutschen Hauptdreiecksnetzes (DHDN 1990) im System 42/83***
Reichart, Gerhard, Deutsche Geodaetische Kommission, Germany; Schoch, Henning, Deutsche Geodaetische Kommission, Germany; Contributions to the Common Adjustment of Terrestrial Position Nets and GPS Compression Nets for the Area of the New Federal States; Jan. 1995, pp. 7-25; In German; Also announced as 19970010893; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The diagnosis adjustment in the net block 3 of the German primary triangulation network was carried out, using data from the astronomic and geodetic net of the former German Democratic Republic. The mean coordinate error could be reduced by 75 percent, and a uniform measure scale was obtained within the whole network. Additional distance measurements were introduced as well as the common adjustment of the first and third order terrestrial observations and global positioning system (GPS) observations, whose available accuracy was estimated.
Author (ESA)
Earth Observations (From Space); Global Positioning System; Geodetic Coordinates; Data Processing

19970010895 Deutsche Geodaetische Kommission, Frankfurt Germany
Coordinate Calculation of the Position Nets of First and Third Order in the Reference System ETRS89 for the Area of the New Federal States ***Koordinatenberechnung der Lagenetze 1. und 3. Ordnung im Bezugssystem ETRS89 fuer das Gebiet der neuen Bundeslaender***
Reichardt, Gerhard, Deutsche Geodaetische Kommission, Germany; Schoch, Henning, Deutsche Geodaetische Kommission, Germany; Luthardt, Jens, Deutsche Geodaetische Kommission, Germany; Contributions to the Common Adjustment of Terrestrial Position Nets and GPS Compression Nets for the Area of the New Federal States; Jan. 1995, pp. 27-83; In German; Also announced as 19970010893; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The computations of coordinates of the first and third order trigonometric network in the reference system ETRS89 were performed within the net block 3 using the common adjustment of the first and third order terrestrial observations and the available global positioning system (GPS) densification networks, according to the method of the dynamic net adjustment. The datum of the ETRS89 was predetermined by 29 DREF (German acronym for the German GPS reference net) points located in the net block

3. Mean standard deviations of the coordinates were estimated for 4500 points and evaluated to around 15 mm. It is shown that the coordinates derived from terrestrial observations contain no systematic error components.
Author (ESA)
Global Positioning System; Geodetic Coordinates; Datum (Elevation); Standard Deviation

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19970010400 Naval Air Warfare Center, Patuxent River, MD USA
Simulation Validation Through Linear Model Comparison
Balderson, Keith, Naval Air Warfare Center, USA; Gaublomme, Donald P., Naval Air Warfare Center, USA; Thomas, Justin W., Naval Air Warfare Center, USA; May 22, 1996; 12p; In English
Report No.(s): AD-A309804; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Manned Flight Simulator at the Naval Air Warfare Center in Patuxent River, MD maintains high fidelity fixed and rotary wing simulation models. The aircraft simulations are utilized for a wide range of activities including flight test support, pilot training, and control law analysis and design. Validating aircraft math models against flight test data is an important part of the simulation process. Linear model comparison was used to validate the lateral-directional dynamic modes of the V-22 tilt-rotor aircraft in airplane mode. In this technique, linear model approximations of the simulation and aircraft dynamics are calculated independently and then compared. The simulation linear state-space model was extracted from the nonlinear V-22 simulation using a perturbation method. The aircraft linear state-space model was fit to flight test data from lateral-directional maneuvers using parameter identified tools. Time history comparison were used to verify both linear models. Comparison of the lateral-directional modes and the stability and control derivatives of the two models were made. The differences between the two models were used to locate potential problems with the nonlinear simulation.
DTIC
Mathematical Models; Flight Simulators; Aircraft Models; Tilt Rotor Aircraft; Lateral Stability; Dynamic Response

19970010660 National Aerospace Lab., Flight Research Div., Tokyo, Japan
Simulation Study for a Fire Helicopter, Part 2, Effects of Turbulent Wind on the Efficiency and Safety
Okuno, Yoshinori, National Aerospace Lab., Japan; Funabiki, Kohei, National Aerospace Lab., Japan; Harada, Masashi, National Aerospace Lab., Japan; Jun. 1996; 22p; In Japanese
Report No.(s): NAL TR-1293; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Simulation tests of a fire helicopter are performed using a flight simulator. A fire helicopter is being developed by the Tokyo Fire Department, which has the capability to suppress a fire in high-rise buildings by discharging pressurized water while hovering near the fire. One of the problems in realizing this concept is the heavily turbulent wind around buildings that may cause difficulties in maintaining a stable hover. Wind tunnel tests and theoretical calculations are performed to clarify the characteristics of the turbulence. Based on these results, some wind models around a high-rise building are developed which are available In real time flight simulations. Extensive piloted simulations are carried out using these models, demonstrating that the fire helicopter can suppress fires efficiently up to a wind speed of 7 m/s. Safety criteria are also proposed for when the helicopter approaches a building. The results prove the effectiveness and safety of the fire helicopter and finally led to the approval of experimental operation beginning in March 1996.
Author
Wind Tunnel Tests; Flight Simulation; Helicopters; Safety; Fire Fighting

19970010666 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France
Integrated Airframe Design Technology ***Les Technologies de la conception integree des cellules***
Integrated Airframe Design Technology; Oct. 1996; 174p; In English; In French; 82nd; Structures and Materials Panel, 8-9 May 1996, Sesimbra, Portugal; Also announced as 19970010667 through 19970010680
Report No.(s): AGARD-R-814; ISBN-92-836-0030-4; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche

Integrated airframe design embraces the concept of bringing together all of the aspects of airframe design, including various disciplines such as structures, materials, aerodynamics, propulsion, systems, controls, and manufacturing from conceptual design all the way through to the final product and its repair and maintenance. The results of this AGARD Workshop on Integrated Air-

frame Design emphasized that the recent and future advances in high-performance computer hardware and software systems provide the opportunity to create a process that will allow these disciplines to rapidly interact with one another.
Author
Multidisciplinary Design Optimization; Airframes; Computer Aided Design; Design Analysis; Concurrent Engineering; Finite Element Method; Structural Design; Structural Analysis; Conferences; Computer Programs

19970010667 Northrop Grumman Corp., Pico Rivera, CA USA
Integrated Airframe Design Technology at Northrop Grumman
Wiley, Dianne, Northrop Grumman Corp., USA; Integrated Airframe Design Technology; Oct. 1996; 9p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Design for affordability is the new paradigm for the 21st Century. Balancing the conflicting goals of systems superiority and systems affordability is the challenge of multidisciplinary design optimization on a larger scale than has ever been done before. Addressing the realities of he future aerostructures business has led to a new vocabulary. Northrop Grumman pioneered many of these concepts on the B-2 Program during the 1980's. Since then we have taken the lessons learned, coupled with commercial off the shelf software and integrated them into formal protocols for affordable aircraft production, resulting in a Toolbox for Affordable Production.
Author
Multidisciplinary Design Optimization; Aircraft Production; Computer Aided Manufacturing; Airframes; Computer Aided Design

19970010668 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
Integrated Airframe Design at Lockheed Martin Tactical Aircraft Systems
Love, Michael H., Lockheed Martin Tactical Aircraft Systems, USA; Oct. 1996; 12p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Airframe product design integration is continuously evolving with the goal of facilitating the design team's mission; development of 'build-to' datasets that provide the complete definition of hardware to be manufactured. This paper surveys design tools, practices, and strategies in Lockheed Martin Tactical Aircraft System's (LMTAS) integrated environment. Airframe design is a set of structured and chaotic processes coordinated to establish product function and fit, affordability, producability, and structural certification. Integration encompasses the data development, data transfer, and knowledge development necessary to create the product. Evolution of integrated design at LMTAS is resulting from influx of advanced technologies such as scientific visualization, multidisciplinary analysis and optimization, and data exchange standards. Illustrations of advanced technologies and their implementation at Lockheed Martin Tactical Aircraft Systems are provided in the context of conceptual design, preliminary design and detailed design. New aircraft design programs offer opportunities.
Author
Aircraft Design; Airframes; Scientific Visualization; Multidisciplinary Design Optimization; Computer Aided Design

19970010669 Daimler-Benz Aerospace A.G., Munich, Germany
A Common Framework Architecture for an Integrated Aircraft Design
Krammer, J., Daimler-Benz Aerospace A.G., Germany; Vilsmeier, J., Daimler-Benz Aerospace A.G., Germany; Schuhmacher, G., Siegen Univ., Germany; Weber, C., Siegen Univ., Germany; Oct. 1996; 10p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The paper first describes the architecture of the framework and the processes which are implemented. After that the concept of a common optimization model formulation based on the design element method and its integration in the overall process is explained. As an example for the so-called 'constructive design model' the optimal layout of a stiffened panel under buckling loads is considered.
Author
Aircraft Design; Multidisciplinary Design Optimization; Computer Aided Design; Architecture (Computers)

19970010670 British Aerospace Defence Ltd., Preston, UK
Integrated Airframe Design Technology
Thompson, D., British Aerospace Defence Ltd., UK; Oct. 1996; 6p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Multi-disciplinary Design Optimization (MDO) requires sensitivities and model data to be handled among many applications, such as FE and CFD codes. Each iteration to the optimum design requires a re-execution of some of the applications, present-

ing a new input data and receiving updated sensitivities. All this takes place within applications moving from a central mainframe to numerous UNIX workstations. Therefore, in order to perform MDO one has to solve problems of transferring data and executing remote applications. Most applications are to be available during a lengthy optimization process, which affects the reliability of networks and computers. This paper will outline our vision of MDO and detail our work and problems in performing: remote application execution; data transfer over local and wide networks; network topology to give redundant data paths; redundant computers via multiple application installations; real-time interactive guidance of the optimization process; and dynamically linking distributed applications to parallelize the optimization process across workstations and supercomputers.
Author
Airframes; Multidisciplinary Design Optimization; Data Transfer (Computers); Computer Systems Performance; Real Time Operation

19970010672 Aerospatiale, Paris, France
A Concurrent Engineering Product- Airbus Aircraft Technology ***Developpement et ingenierie simultanee- les produits airbus***
Carcasses, A., Aerospatiale, France; Oct. 1996; 11p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Aspects of concurrent engineering relating to European Airbus are described.
Derived from text
Concurrent Engineering; European Airbus; Product Development

19970010673 Dassault Aviation, Saint-Cloud, France
Design and Analyses of Airframes ***Conception et Analyses des Cellules***
Petiau, Christian, Dassault Aviation, France; Oct. 1996; 11p; In French; Also announced as 19970010666; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

We present the process of drawing-analysis interactions for airframes design, based on the capabilities of our coupled CAD analysis tools CATIA and ELFINI: (1) for preliminary project, global definition of airframe by CATIA objects associated with a global Finite Element model and with a mathematical optimization of the dimensioning; many, fast and cheap evaluations of alternate architectures are possible; and (2) for development phase, detail drawings of parts with CAD 'solid' models, lay-out studies with a digital mock-up, verifications by non linear finite element analyses or by partial tests; the present difficulty of the process restricts design iterations. Due to limitations of numerical means and of partial tests, the demonstration of structure qualification must be jointly founded on general tests (flight tests, static test airframe). Prospects of tool development are revoked: multidisciplinary and multilevel optimizations, availability of repeatable Design Historical Records, Feature Modeling generalized to analyses and to optimization. These tools will provide more means for iterations at every project stage, they allow to fully master costs, time and risks in project development phases; yet they present the problem of preservation of innovation capability with the full standardization of designs and processes.
Author
Airframes; Computer Aided Design; Finite Element Method; Mathematical Models

19970010674 Rockwell International Corp., North American Aircraft Div., Seal Beach, CA USA
Automated Structural Analysis Process at Rockwell
Dobbs, S. K., Rockwell International Corp., USA; Schwanz, R. C., Rockwell International Corp., USA; Abdi, F., Alpha STAR Corp., USA; Oct. 1996; 12p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

An automated and integrated structural design and analysis process for aircraft and weapons airframes is described. The primary purpose of the process is to reduce design cycle time and to tie structural design and performance to 'design to cost' analyses. This capability is included in a general system, called the Affordable Systems Optimization Process (ASOP), which includes five separate, but linked systems: The 'Design to Cost' Tool, Automated Structural Analysis Process (ASAP), an ultra rapid finite element model generator and transformation pre/post processor (COMETRAN), Active Aeroelastic Wing Optimizer (AAW), and CFD based static and dynamic aeroelasticity (ENSAERO). This evolving system has already significantly reduced structural design cycle time, and is being expanded to include more design disciplines.
Author
Structural Analysis; Structural Design; Airframes; Design to Cost; Aeroelasticity; Computational Fluid Dynamics; Multidisciplinary Design Optimization; Aircraft Design

19970010675 Construcciones Aeronauticas S.A., Stress Dept., Madrid, Spain

A Simplified Approach to the Multidisciplinary Design Optimization for Large Aircraft Structures

Morell, Miguel Angel, Construcciones Aeronauticas S.A., Spain; Huertas, Manuel, Construcciones Aeronauticas S.A., Spain; Gomez, Jose Carlos, Construcciones Aeronauticas S.A., Spain; Oct. 1996; 12p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The last tendencies in optimization indicate that in early design stages, it is necessary to perform multidisciplinary analysis for designing large structures. This paper presents a simple but very efficient tool that CASA is using during the preliminary stages of the aircraft structural design for defining and selecting the structural characteristics. The development of this software package, ALACA, was undertaken by CASA Engineering Directorate in the last years for the purpose of designing the composite wing of CASA 3000 Aircraft. ALACA optimizes wing structures satisfying all the structural requirements (weights, static loading, material, fatigue, residual strength, manufacturing, flutter, etc.). The main advantage of the program is that it is not necessary to use finite element techniques, which make it easier than other available codes and allows to use it in the earliest phases of the project (preliminary design) before freezing the general arrangement of the structure. The results from the CASA 3000 studies show the reliability and efficiency of ALACA as a design tool.

Author

Multidisciplinary Design Optimization; Aircraft Structures; Aircraft Design; Applications Programs (Computers)

19970010676 Vrije Univ., Analyse van Strukturen, Brussels, Belgium

Monte Carlo-Based Stochastic Finite Element Method: A New Approach for Structural Design

vanVinckenroy, G., Vrije Univ., Belgium; deWilde, W. P., Vrije Univ., Belgium; Vantomme, J., Royal Military Academy, Belgium; Oct. 1996; 12p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The paper summarizes the principles of the Monte Carlo based finite element method. The method relies on the characterization, by means of stochastic tools, of the mechanical behavior of different materials with uncertainties taken into account. A procedure based on the combination of three methods for estimating distribution parameters has been set up to ensure a correct estimation of the material properties that are used as input for the finite element model. The stochastic engineering design method is then applied to beam structures. Although the present report is limited to the linear analysis, it is concluded that attention should be paid to the Monte Carlo sample size required to obtain accurate results and to the appropriate choice of the finite element mesh to avoid excessive CPU time consumption and errors in the interpretation of the results.

Author

Monte Carlo Method; Finite Element Method; Structural Design; Composite Structures; Probability Distribution Functions

19970010677 Wright Lab., Aero Propulsion and Power Directorte; Turbine Engine Div., Wright-Patterson AFB, OH USA

The Gas Turbine Engine Conceptual Design Process: An Integrated Approach

Stricker, Jeffrey M., Wright Lab., USA; Oct. 1996; 7p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The conceptual design of gas turbine engines is a complex process which crosses many engineering disciplines. Aerodynamics, thermodynamics, heat transfer, materials design/selection, and structural analysis are a few of the fields employed when downselecting an appropriate engine configuration. Because of the complexity involved, it is critical to have a process which narrows engine options without missing the 'optimum' engine design. The following paper will describe a typical process used at the conceptual design level. Various steps which will be described include propulsion requirements definition, uninstalled engine cycle performance, component design, engine flowpath/weight prediction, installation effects, and the influence of engine design trades on aircraft size and performance. The engine design process is not completely linear. The steps listed above are highly interdependent. A number of iterations are usually necessary in selecting a final engine design. This paper will describe several of the interrelationships between the various steps. Frequently, the engine conceptual design process has special considerations which require additional engine analyses. Some modern day examples of these criteria include reduced observables and cost reduction. How these variations are incorporated into the conceptual design process will be discussed.

Author

Gas Turbine Engines; Engine Design; Aircraft Engines; Performance Prediction

19970010678 Instituto Nacional de Tecnica Aeroespacial, Madrid, Spain

Computational Assessment on Integrated Analysis and Design

Conca, J. M. G., Instituto Nacional de Tecnica Aeroespacial, Spain; Oct. 1996; 6p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

One important question in analysis and design is how much error (e(sub N)) has the solution (x(sub N))? The answer is very difficult even if limited strictly to the computation. For two decades the author has researched and developed a Procedure in the University and the INTA to give an answer acceptable to Industry. This paper gives the Fundamentals and Applications to two Aerospace Projects: (1) Airplane: C(sub L alpha) (C(sub L) slope); and (2) Satellite: lambda(sub min) (min eigenvalue) whose solutions (x) are unknown, but they can be computed as shown.
Author
Analysis (Mathematics); Error Analysis; Convergence; Procedures

19970010693 Naval Air Warfare Center, Patuxent River, MD USA
F-14 Lantirn Flight Testing. The Cat is Back!!
Mnich, William, Naval Air Warfare Center, USA; Apr. 18, 1996; 30p; In English
Report No.(s): AD-A309772; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The system is currently operational on both the F-15 and F-16. Shown here on the Strike Eagle are the key elements of LANTIRN, which features two independant pod-mounted sensors. On the left side is the Navigation pod containing both the Terrain-Following Radar and Navigation FLIR, images from which can be presented to the pilot on the Wide FOV raster HUD for low-level navigation. The targeting pod is carried on the other side, and incorporates the targeting FLIR and laser rangefinder systems. With the full two-pod system, the F-l5E can perform the low-altitude strike mission day or night in almost any weather conditions. It's a magnificent weapons system with an outstanding combat record, and was one of the stars of Desert Storm. Unfortunately, the F-15 can't land on an aircraft carrier. So, why did the Navy decide to incorporate the LANTIRN targeting pod on the F-14, and how did we do it?
DTIC
Air Navigation; Pods (External Stores); Radar Navigation; Terrain Following; Night; Low Altitude; Laser Range Finders; F-15 Aircraft; F-14 Aircraft; Combat

19970010764 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
Aerodynamic Shape Optimization of Supersonic Aircraft Configurations via an Adjoint Formulation on Parallel Computers
Reuther, James, Research Inst. for Advanced Computer Science, USA; Alonso, Juan Jose, Princeton Univ., USA; Rimlinger, Mark J., NASA Ames Research Center, USA; Jameson, Antony, Princeton Univ., USA; Sep. 1996; 22p; In English; 6th; Symposium on Multidisciplinary Analysis and Optimization, Sep. 1996, USA; Sponsored by NASA Washington, USA; Original contains color illusrations
Contract(s)/Grant(s): NAS2-13721; N00014-92-J-1976; AF-AFOSR-039-91
Report No.(s): NASA-CR-203273; NAS 1.26:203273; AIAA Paper 96-4045; RIACS-TR-96-7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This work describes the application of a control theory-based aerodynamic shape optimization method to the problem of supersonic aircraft design. The design process is greatly accelerated through the use of both control theory and a parallel implementation on distributed memory computers. Control theory is employed to derive the adjoint differential equations whose solution allows for the evaluation of design gradient information at a fraction of the computational cost required by previous design methods (13, 12, 44, 38). The resulting problem is then implemented on parallel distributed memory architectures using a domain decomposition approach, an optimized communication schedule, and the MPI (Message Passing Interface) Standard for portability and efficiency. The final result achieves very rapid aerodynamic design based on higher order computational fluid dynamics methods (CFD). In our earlier studies, the serial implementation of this design method (19, 20, 21, 23, 39, 25, 40, 41, 42, 43, 9) was shown to be effective for the optimization of airfoils, wings, wing-bodies, and complex aircraft configurations using both the potential equation and the Euler equations (39, 25). In our most recent paper, the Euler method was extended to treat complete aircraft configurations via a new multiblock implementation. Furthermore, during the same conference, we also presented preliminary results demonstrating that the basic methodology could be ported to distributed memory parallel computing architectures [241. In this paper, our concem will be to demonstrate that the combined power of these new technologies can be used routinely in an industrial design environment by applying it to the case study of the design of typical supersonic transport configurations. A particular difficulty of this test case is posed by the propulsion/airframe integration.
Author
Parallel Processing (Computers); Aerodynamic Configurations; Aerodynamics; Aircraft Configurations; Aircraft Design; Engine Airframe Integration; Supersonic Transports; Supersonic Aircraft; Wings

19970010770 Research Inst. for Advanced Computer Science, Moffett Field, CA USA

Aerodynamic Shape Optimization of Complex Aircraft Configurations via an Adjoint Formulation

Reuther, James, Research Inst. for Advanced Computer Science, USA; Jameson, Antony, Princeton Univ., USA; Farmer, James, Brigham Young Univ., USA; Martinelli, Luigi, Princeton Univ., USA; Saunders, David, Sterling Software, Inc., USA; Jan. 1996; 24p; In English; 34th; Aerospace Sciences Meeting and Exhibit, Jan. 1996, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): N00014-92-J-1976; AF-AFOSR-0391-91

Report No.(s): NASA-CR-203275; NAS 1.26:203275; RIACS-TR-96-02; AIAA Paper 96-0094; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This work describes the implementation of optimization techniques based on control theory for complex aircraft configurations. Here control theory is employed to derive the adjoint differential equations, the solution of which allows for a drastic reduction in computational costs over previous design methods (13, 12, 43, 38). In our earlier studies (19, 20, 22, 23, 39, 25, 40, 41, 42) it was shown that this method could be used to devise effective optimization procedures for airfoils, wings and wing-bodies subject to either analytic or arbitrary meshes. Design formulations for both potential flows and flows governed by the Euler equations have been demonstrated, showing that such methods can be devised for various governing equations (39, 25). In our most recent works (40, 42) the method was extended to treat wing-body configurations with a large number of mesh points, verifying that significant computational savings can be gained for practical design problems. In this paper the method is extended for the Euler equations to treat complete aircraft configurations via a new multiblock implementation. New elements include a multiblock-multigrid flow solver, a multiblock-multigrid adjoint solver, and a multiblock mesh perturbation scheme. Two design examples are presented in which the new method is used for the wing redesign of a transonic business jet.

Author

Aerodynamic Configurations; Aircraft Configurations; Body-Wing Configurations; Design Analysis; Potential Flow; Airfoils

19970010846 Northrop Grumman Corp., Military Aircraft Div., Hawthorne, CA USA

Structural Integrity Evaluation of the Lear Fan 2100 Aircraft ***Final Report, Nov. 1993 - Oct. 1994***

Kan, H. P., Northrop Grumman Corp., USA; Dyer, T. A., Northrop Grumman Corp., USA; May 1996; 165p; In English

Contract(s)/Grant(s): NAS1-19347

Report No.(s): AD-A311031; DOT/FAA/AR-95/13; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

An in-situ nondestructive inspection was conducted to detect manufacturing and assembly induced defects in the upper two wing surfaces (skin s) and upper fuselage skin of the Lear Fan 2100 aircraft E009. The effects of the defects, detected during the inspection, on the integrity of the structure was analytically evaluated. A systematic evaluation was also conducted to determine the damage tolerance capability of the upper wing skin against impact threats and assembly induced damage. The upper wing skin was divided into small regions for damage tolerance evaluations. Structural reliability, margin of safety, allowable strains, and allowable damage size were computed. The results indicated that the impact damage threat imposed on composite military aircraft structures is too severe for the Lear Fan 2100 upper wing skin. However, the structural integrity is not significantly degraded by the assembly induced damage for properly assembled structures, such as the E009 aircraft.

DTIC

Aircraft Structures; Composite Materials; Composite Structures; Wings; Structural Reliability; Impact Damage; Fuselages

19970010865 Naval Postgraduate School, Monterey, CA USA

Preliminary Vibration Survey of a Suspended Full-Scale OH-6A Helicopter from 0 to 45 Hz

Harris, John H., III, Naval Postgraduate School, USA; Mar. 1996; 76p; In English

Report No.(s): AD-A310775; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Efforts to establish a helicopter research program in structural dynamics at NPS were greatly enhanced when the U. S. Army donated two OH-6A light observation helicopters. One of the helicopters is reserved for ground vibration testing and dynamics research. Vibration measurements are extremely important in predicting and understanding an aircraft's dynamic behavior and durability. A comparison of a helicopters natural frequencies and those frequencies transmitted to the airframe through the rotor system can alert the designer/evaluator to possible dynamic problems. This thesis establishes a baseline vibration test program on the OH-6A helicopter for future testing and comparison to analytic models. The goal of the research is to establish natural frequencies (eigenvalues) principal mode shapes (eigenvectors), and damping characteristics of the OH-6A and to compare these values to test and analytical data obtained from the McDonnell Douglas Helicopter Company.

DTIC

Helicopters; Vibration Measurement; Resonant Frequencies; Vibration Damping; Vibration Mode; Research; Modal Response

19970011097 Continuum Dynamics, Inc., Princeton, NJ USA
Experimental Studies in Helicopter Vertical Climb Performance ***Final Report***
McKillip, Robert M., Jr., Continuum Dynamics, Inc., USA; Feb. 1996; 19p; In English
Contract(s)/Grant(s): NAG2-783
Report No.(s): NASA-CR-203585; NAS 1.26:203585; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Data and analysis from an experimental program to measure vertical climb performance on an eight-foot model rotor are presented. The rotor testing was performed using a unique moving-model facility capable of accurately simulating the flow conditions during axial flight, and was conducted from July 9, 1992 to July 16, 1992 at the Dynamic Model Track, or 'Long Track,' just prior to its demolition in August of 1992. Data collected during this brief test program included force and moment time histories from a sting-mounted strain gauge balance, support carriage velocity, and rotor rpm pulses. In addition, limited video footage (of marginal use) was recorded from smoke flow studies for both simulated vertical climb and descent trajectories. Analytical comparisons with these data include a series of progressively more detailed calculations ranging from simple momentum theory, a prescribed wake method, and a free-wake prediction.
Author
Helicopter Performance; Climbing Flight; Performance Tests; Numerical Analysis; Scale Models; Flow Visualization

19970011190 Princeton Univ., Dept. of Mechanical and Aerospace Engineering, NJ USA
Identification of Rotorcraft Structural Dynamics from Flight and Wind Tunnel Data ***Final Report, Feb. 1991 - Aug. 1992***
McKillip, Robert M., Jr., Princeton Univ., USA; Feb. 1997; 148p; In English
Contract(s)/Grant(s): NAG2-694
Report No.(s): NASA-CR-203586; NAS 1.26:203586; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Excessive vibration remains one one of the most difficult problems that faces the helicopter industry today, affecting all production helicopters at some phase of their development. Vibrations in rotating structures may arise from external periodic dynamic airloads whose frequencies are are close to the natural frequencies of the rotating system itself. The goal for the structures engineer would thus be to design a structure as free from resonance effects as possible. In the case of a helicopter rotor blade these dynamic loads are a consequence of asymmetric airload distribution on the rotor blade in forward flight, leading to a rich collection of higher harmonic airloads that force rotor and airframe response. Accurate prediction of the dynamic characteristics of a helicopter rotor blade will provide the opportunity to affect in a positive manner noise intensity, vibration level, durability, reliability and operating costs by reducing objectionable frequencies or moving them to a different frequency range and thus providing us with a lower vibration rotor. In fact, the dynamic characteristics tend to define the operating limits of a rotorcraft. As computing power has increased greatly over the last decade, researchers and engineers have turned to analyzing the vibrational characteristics of aerospace structures at the design and development stage of the production of an aircraft. Modern rotor blade construction methods lead to products with low mass and low inherent damping so careful design and analysis is required to avoid resonance and an undesirable dynamic performance. In addition, accurate modal analysis is necessary for several current approaches in elastic system identification and active control.
Derived from text
Rotary Wing Aircraft; Accelerometers; Dynamic Response; Modal Response; Rotary Wings; Parameter Identification; Spectrum Analysis; Finite Element Method

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19970010448 NASA Dryden Flight Research Center, Edwards, CA USA
Development of a Closed-Loop Strap Down Attitude System for an Ultrahigh Altitude Flight Experiment
Whitmore, Stephen A., NASA Dryden Flight Research Center, USA; Fife, Mike, Massachusetts Inst. of Tech., USA; Brashear, Logan, California Univ., USA; Jan. 1997; 34p; In English; 35th; Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 1997, Reno, NV, USA
Contract(s)/Grant(s): RTOP 537-10-40
Report No.(s): NASA-TM-4775; NAS 1.15:4775; H-2140; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A low-cost attitude system has been developed for an ultrahigh altitude flight experiment. The experiment uses a remotely piloted sailplane, with the wings modified for flight at altitudes greater than 100,000 ft. Mission requirements deem it necessary to measure the aircraft pitch and bank angles with accuracy better than 1.0 deg and heading with accuracy better than 5.0 deg.

Vehicle cost restrictions and gross weight limits make installing a commercial inertial navigation system unfeasible. Instead, a low-cost attitude system was developed using strap down components. Monte Carlo analyses verified that two vector measurements, magnetic field and velocity, are required to completely stabilize the error equations. In the estimating algorithm, body-axis observations of the airspeed vector and the magnetic field are compared against the inertial velocity vector and a magnetic-field reference model. Residuals are fed back to stabilize integration of rate gyros. The effectiveness of the estimating algorithm was demonstrated using data from the NASA Dryden Flight Research Center Systems Research Aircraft (SRA) flight tests. The algorithm was applied with good results to a maximum 10’ pitch and bank angles. Effects of wind shears were evaluated and, for most cases, can be safely ignored.
Author
Altitude Simulation; Flight Tests; Feedback Control

19970010464 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France
Introduction to Avionics Flight Test ***Introduction aux essais des systemes d’armes***
Clifton, James M., Naval Air Warfare Center, USA; Nov. 1996; 346p; In English
Report No.(s): AGARD-AG-300-Vol-15; ISBN-92-836-1045-8; Copyright Waived; Avail: CASI; A15, Hardcopy; A03, Microfiche

Modern military aircraft rely heavily on highly complex electronic systems to make them effective. These systems can compromise up to 80% of the cost of the aircraft. As new systems are developed, numerous tests are needed to provide feedback in the iterative design process and to ensure that the design parameters are met. This AGARDograph is an attempt to present the rudimentary knowledge necessary for a test pilot or engineer to develop and execute a cost effective, quick test of a modern avionics system.
Author
Avionics; Flight Tests; Airborne Radar; Cost Effectiveness; Military Aircraft; Complex Systems; Air Navigation; Electro-Optics

19970010629 Armstrong Lab., Systems Research Branch, Brooks AFB, TX USA
Test and Evaluation of the Avionic Instruments, Inc. Frequency Converter ***Final Report***
Hale, Jacqueline D., Armstrong Lab., USA; Hade, Edward W., Armstrong Lab., USA; May 1996; 22p; In English
Contract(s)/Grant(s): AF Proj. 7184
Report No.(s): AD-A309280; AL/CF-TR-1996-0057; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

HQ AMC/SGXR, being the lead agent responsible for procuring an interface device implementing compatibility of medical equipment using 115VAC/60 Hz single phase power to 115VAC/400 Hz three phase power, requested Aeromedical Research to evaluate converter devices that could fulfill this need. The Avionic Frequency Converter is an electronic device that converts aircraft 400 Hz, three phase, 115-200 Vrms into 60 Hz, single phase, 115 Vrms providing up to 3500 watts of power. Aeromedical Research staff members within the Systems Research Branch, consider the unit acceptable for use in the aeromedical evacuation environment.
DTIC
Frequency Converters; Medical Equipment; Aerospace Medicine; Performance Tests; Avionics

19970010837 SRI International Corp., Menlo Park, CA USA
NASA DC-8 Airborne Scanning Lidar Sensor Development
Nielsen, Norman B., SRI International Corp., USA; Uthe, Edward E., SRI International Corp., USA; Kaiser, Robert D., SRI International Corp., USA; Tucker, Michael A., Raytheon Aerospace Co., USA; Baloun, James E., Raytheon Aerospace Co., USA; Gorordo, Javier G., Raytheon Aerospace Co., USA; Jun. 1996; 6p; In English; 2nd; International Airborne Remote Sensing Conference and Exhibition, 24-27 Jun. 1996, San Francisco, CA, USA
Contract(s)/Grant(s): NCC2-885
Report No.(s): NASA-CR-203208; NAS 1.26:203208; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The NASA DC-8 aircraft is used to support a variety of in-situ and remote sensors for conducting environmental measurements over global regions. As part of the atmospheric effects of aviation program (AEAP) the DC-8 is scheduled to conduct atmospheric aerosol and gas chemistry and radiation measurements of subsonic aircraft contrails and cirrus clouds. A scanning lidar system is being developed for installation on the DC-8 to support and extend the domain of the AEAP measurements. Design and objectives of the DC-8 scanning lidar are presented.
Author
DC 8 Aircraft; Optical Radar; Airborne Equipment; Environmental Monitoring; Remote Sensors; In Situ Measurement; Atmospheric Chemistry; Product Development

19970011197 Bristol Univ., Dept. of Aerospace Engineering., UK

Reconfigurable integrated modular avionics, Report 3, Analysis of configuration and redundancy requirements (version 1.01)

Omiecinski, Tomasz, Bristol Univ., UK; Jun. 01, 1996; 43p; In English

Report No.(s): Rept-747; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The availability and reliability of avionics systems were investigated. Reconfigurable integrated modular avionics (RIMA) systems are expected to be employed in civil aircraft as a continuation of the concept of integrated modular avionics (IMA). The research concerns three different types of avionics systems: black boxes, IMA, and RIMA. The investigation is focused on the redundancy of processing modules with some additional considerations given to other systems. Problems of software replication and memory requirements with respect to the system configuration for RIMA designs are considered.

Author (ESA)

Avionics; Reliability Analysis; Systems Engineering; Electronic Equipment

19970011198 Bristol Univ., Dept. of Aerospace Engineering., UK

Reconfigurable integrated modular avionics. Report 4: Analysis of requirements for autonomous dynamic reconfiguration schemes (version 1.01), Report 4, Analysis of requirements for autonomous dynamic reconfiguration schemes (version 1.01)

Omiecinski, Tomasz, Bristol Univ., UK; Jul. 20, 1996; 36p; In English

Report No.(s): Rept-748; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The availability and reliability of avionics systems were investigated. Reconfigurable integrated modular avionics (RIMA) systems are expected to be employed in civil aircraft as a continuation of the concept of integrated modular avionics (IMA). The reconfiguration and recovery of processes in RIMA systems and their impact on the system's safety were investigated. Concepts involving reconfigurable avionics and reconfiguration schemes are defined. Certification issues related to RIMA systems were identified, and guidelines on reconfiguration algorithms are given.

Author (ESA)

Safety Factors; Avionics; Reliability Analysis; Algorithms; Systems Analysis

19970011216 Bristol Univ., Dept. of Aerospace Engineering., UK

Reconfigurable integrated modular avionics, Report 2, Implementation of Markov analysis into availability and reliability assessment of RIMA systems (version 1.01)

Omiecinski, Tomasz, Bristol Univ., UK; May 15, 1996; 20p; In English

Report No.(s): Rept-749; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The availability and reliability of avionics systems were investigated. Reconfigurable integrated modular avionics (RIMA) systems are expected to be employed in civil aircraft as a continuation of the concept of integrated modular avionics (IMA). The Markov approach to the availability and reliability analysis is presented. An implementation of the RIMA, focused on functional levels, is presented.

Author (ESA)

Markov Processes; Avionics; Reliability Analysis; Systems Engineering

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19970010414 NASA Lewis Research Center, Cleveland, OH USA

Wave Engine Topping Cycle Assessment

Welch, Gerard E., Army Research Lab., USA; Dec. 1996; 17p; In English; 35th; Aerospace Sciences Meeting and Exhibit, 6-10 Jan. 1997, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 505-62-10

Report No.(s): NASA-TM-107371; NAS 1.15:107371; AIAA Paper 97-0707; ARL-TR-1284; E-10539; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The performance benefits derived by topping a gas turbine engine with a wave engine are assessed. The wave engine is a wave rotor that produces shaft power by exploiting gas dynamic energy exchange and flow turning. The wave engine is added to the

baseline turboshaft engine while keeping high-pressure-turbine inlet conditions, compressor pressure ratio, engine mass flow rate, and cooling flow fractions fixed. Related work has focused on topping with pressure-exchangers (i.e., wave rotors that provide pressure gain with zero net shaft power output); however, more energy can be added to a wave-engine-topped cycle leading to greater engine specific-power-enhancement The energy addition occurs at a lower pressure in the wave-engine-topped cycle; thus the specific-fuel-consumption-enhancement effected by ideal wave engine topping is slightly lower than that effected by ideal pressure-exchanger topping. At a component level, however, flow turning affords the wave engine a degree-of-freedom relative to the pressure-exchanger that enables a more efficient match with the baseline engine. In some cases, therefore, the SFC-enhancement by wave engine topping is greater than that by pressure-exchanger topping. An ideal wave-rotor-characteristic is used to identify key wave engine design parameters and to contrast the wave engine and pressure-exchanger topping approaches. An aerodynamic design procedure is described in which wave engine design-point performance levels are computed using a one-dimensional wave rotor model. Wave engines using various wave cycles are considered including two-port cycles with on-rotor combustion (valved-combustors) and reverse-flow and through-flow four-port cycles with heat addition in conventional burners. A through-flow wave cycle design with symmetric blading is used to assess engine performance benefits. The wave-engine-topped turboshaft engine produces 16% more power than does a pressure-exchanger-topped engine under the specified topping constraints. Positive and negative aspects of wave engine topping in gas turbine engines are identified.
Author
Wave Generation; Engine Design; Gas Turbine Engines; Topping Cycle Engines; Rotors; Shafts (Machine Elements); Turboshafts; Elastic Waves

19970010765 NASA Lewis Research Center, Cleveland, OH USA
Experimental Visualization of Flows in Packed Beds of Spheres
Hendricks, R. C., NASA Lewis Research Center, USA; Lattime, S., B and C Engineering Associates, Inc., USA; Braun, M. J., Akron Univ., USA; Athavale, M. M., CFD Research Corp., USA; Jan. 1997; 15p; In English; 1st; Pacific Symposium on Flow Visualization and Image Processing, 23-26 Feb. 1997, Honolulu, HI, USA; Sponsored by Hawaii Univ., USA
Contract(s)/Grant(s): RTOP 233-1B-1B
Report No.(s): NASA-TM-107365; NAS 1.15:107365; E-10527; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The flow experiment consisted of an oil tunnel, 76 x 76 mm in cross-section, packed with lucite spheres. The index of refraction of the working fluid and the spheres were matched such that the physical spheres invisible to the eye and camera. by seeding the oil and illuminating the packed bed with planar laser light sheet, aligned in the direction of the bulk flow, the system fluid dynamics becomes visible and the 2-D projection was recorded at right angles to the bulk flow. The planar light sheet was traversed from one side of the tunnel to the other providing a simulated 3-D image of the entire flow field. The boundary interface between the working fluid and the sphere rendered the sphere black permitting visualization of the exact locations of the circular interfaces in both the axial and transverse directions with direct visualization of the complex interstitial spaces between the spheres within the bed. Flows were observed near the surfaces of a plane and set of spheres as well as minor circles that appear with great circles and not always uniformly ordered. In addition to visualizing a very complex flow field, it was observed that flow channeling in the direction of the bulk flow occurs between sets of adjacent spheres. Still photographs and video recordings illustrating the flow phenomena will be presented.
Author
Porosity; Porous Materials; Oils; Fluid Dynamics; Flow Distribution; Flow Visualization

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19970010502 NASA Dryden Flight Research Center, Edwards, CA USA
Extraction of Lateral-Directional Stability and Control Derivatives for the Basic F-18 Aircraft at High Angles of Attack
Iliff, Kenneth W., NASA Dryden Flight Research Center, USA; Wang, Kon-Sheng Charles, Sparta, Inc., USA; Feb. 1997; 42p; In English
Contract(s)/Grant(s): RTOP 505-68-50
Report No.(s): NASA-TM-4786; H-2143; NAS 1.15:4786; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The results of parameter identification to determine the lateral-directional stability and control derivatives of an F-18 research aircraft in its basic hardware and software configuration are presented. The derivatives are estimated from dynamic flight data using a specialized identification program developed at NASA Dryden Flight Research Center. The formulation uses the linea-

rized aircraft equations of motions in their continuous/discrete form and a maximum likelihood estimator that accounts for both state and measurement noise. State noise is used to model the uncommanded forcing function caused by unsteady aerodynamics, such as separated and vortical flows, over the aircraft. The derivatives are plotted as functions of angle of attack between 3 deg and 47 deg and compared with wind-tunnel predictions. The quality of the derivative estimates obtained by parameter identification is somewhat degraded because the maneuvers were flown with the aircraft's control augmentation system engaged, which introduced relatively high correlations between the control variables and response variables as a result of control motions from the feedback control system.
Author
Directional Stability; Lateral Stability; Angle of Attack; Aircraft Control; Parameter Identification; F-18 Aircraft; Research Vehicles; Maximum Likelihood Estimates

19970011192 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Distributed-Roughness Effects on Stability and Transition In Swept-Wing Boundary Layers ***Final Report, 17 May - 31 Dec. 1996***
Carrillo, Ruben B., Jr., Arizona State Univ., USA; Reibert, Mark S., Arizona State Univ., USA; Saric, William S., Arizona State Univ., USA; Jan. 28, 1997; 379p; In English
Contract(s)/Grant(s): NCC1-194; ZA0078
Report No.(s): NASA-CR-203580; NAS 1.26:203580; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche

Boundary-layer stability experiments are conducted in the Arizona State University Unsteady Wind Tunnel on a 45 deg swept airfoil. The pressure distribution and test conditions are designed to suppress Tollmien-Schlichting disturbances and provide crossflow-dominated transition. The surface of the airfoil is finely polished to a near mirror finish. Under these conditions, submicron surface irregularities cause the naturally occurring stationary crossflow waves to grow to nonuniform amplitudes. Spanwise-uniform stationary crossflow disturbances are generated through careful control of the initial conditions with full-span arrays of micron-high roughness elements near the attachment line. Detailed hot-wire measurements are taken to document the stationary crossflow structure and determine growth rates for the total and individual-mode disturbances. Naphthalene flow visualization provides transition location information. Roughness spacing and roughness height are varied to examine the effects on transition location and all amplified wavelengths. The measurements show that roughness spacings that do not contain harmonics equal to the most unstable wavelength as computed by linear stability theory effectively suppress the most unstable mode. Under certain conditions, subcritical roughness spacing delays transition past that of the corresponding smooth surface.
Author
Boundary Layer Stability; Wind Tunnel Tests; Swept Wings; Cross Flow; Airfoils; Surface Roughness; Flow Visualization; Boundary Layer Transition

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19970010375 NASA Lewis Research Center, Cleveland, OH USA
Users Guide for NASA Lewis Research Center DC-9 Reduced-Gravity Aircraft Program
Neumann, Eric S., NASA Lewis Research Center, USA; Withrow, James P., NASA Lewis Research Center, USA; Yaniec, John S., NASA Lewis Research Center, USA; Dec. 1996; 78p; In English
Contract(s)/Grant(s): RTOP 694-03-0C
Report No.(s): NASA-TM-106755; NAS 1.15:106755; E-9175-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The document provides guidelines and information for users of the DC-9 Reduced-Gravity Aircraft Program. It describes the facilities, requirements for test personnel, equipment design and installation, mission preparation, and in-flight procedures. Those who have used the KC-135 reduced-gravity aircraft will recognize that many of the procedures and guidelines are the same.
Author
DC 9 Aircraft; Microgravity; In Situ Measurement

19970010606 National Aerospace Lab., Aircraft Aerodynamics Div., Kakuda, Japan
The NAL 0.2m Supersonic Wind Tunnel
Sawada, Hideo, National Aerospace Lab., Japan; Suzuki, Kouichi, National Aerospace Lab., Japan; Hanzawa, Asao, National

Aerospace Lab., Japan; Kohno, Takasi, National Aerospace Lab., Japan; Kunimasu, Tetsuya, National Aerospace Lab., Japan; Jul. 1996; 14p; In English

Report No.(s): NAL-TR-1302T; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A small supersonic wind tunnel (The NAL 0.2m Supersonic Wind Tunnel) was built at the National Aerospace Laboratory, Japan in 1995. The test section is 0.2 m x O.2 m in cross section and 0.4 m long. Mach number can be set to any value from 1.5 to 2.5 by its flexible plate nozzle. Total pressure can be up to 0.15 MPa and total temperature is around 330 K. This tunnel has two unique points. The main structure and compressor were designed to be available at cryogenic temperatures. The contraction ratio to the test section is about 28, and the boundary layer suction device is mounted at the contraction, in order to establish low turbulent flow.

Author

Supersonic Wind Tunnels; Test Chambers; Cryogenic Wind Tunnels

19970010640 National Aerospace Lab., Control Systems Div., Tokyo, Japan

Control of Experimental Model and the Data Acquistion System in ALFLEX Dynamic Wind Tunnel Tests

Motoda, Toshikazu, National Aerospace Lab., Japan; Sakoda, Yukie, Nippon Electric Co. Ltd., Japan; Shimomura, Takashi, Osaka Univ., Japan; Yanagihara, Masaaki, National Aerospace Lab., Japan; Tsukamoto, Taro, National Aerospace Lab., Japan; Sasa, Shuichi, National Aerospace Lab., Japan; Takizawa, Minoru, National Aerospace Lab., Japan; Nagayasu, Masahiko, National Aerospace Lab., Japan; May 1996; 36p; In Japanese

Report No.(s): NAL TR-1291; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dynamic wind tunnel tests have been conducted at the National Aerospace Laboratory (NAL) since 1989, while the Automatic Landing FLight Experiment (ALFLEX) was being planned to develop an automatic landing technique. ALFLEX is one of the experiments supporting HOPE, the Japanese unmanned spacecraft programme. Prior to flight experiments, dynamic wind tunnel tests were conducted using a 40% ALFLEX scale model in order to evaluate the performance of the ALFLEX control system and to determine aerodynamic parameters. During the tests, control surface deflection commands were sent to the model and measured data were transmitted to an external computer and stored. This paper describes the control and data acquisition functions and algorithms developed for the dynamic wind tunnel tests. Data acquired from the tests demonstrate that the system performs well.

Author

Wind Tunnel Tests; Dynamic Tests; Data Acquisition; Landing Simulation; Automatic Landing Control

19970010644 National Aerospace Lab., Aircraft Aerodynamics Div., Tokyo, Japan

Pressure Control Simulations of Ventilated Adaptive Walls

Nakamura, Masayoshi, National Aerospace Lab., Japan; Kuwano, Naoaki, National Aerospace Lab., Japan; Jun. 1996; 14p; In Japanese

Report No.(s): NAL TR-1295; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because aerodynamic interference between an airfoil model and wind-tunnel walls cannot be avoided, the concept of an adaptive-wall to reduce the previous interferences has been considered. This paper presents numerical simulations of pressure control at a ventilated adaptive-wall for a two-dimensional wind-tunnel. Numerical inner and auter flows of the wind-tunnel are calculated simultaneously and independently on the basis of Euler equations using a finite difference method in the Cartesian grid. The concept of an adaptive-wall requires that the inner flow match the outer flow at control surfaces. This requirement is satisfied by matching of the flow direction at the control surfaces. Numerical adaptive-wall wind-tunnel tests of the NACA0012 airfoil are being performed to demonstrate the possible applications of adaptive-wall control. Several calculated results of airfoil abilities in the numerical wind tunnel are compared with experimental and other calculated results.

Author

Pressure Recorders; Ventilation; Control Surfaces; Differential Equations; Directional Control; Models; Simulation; Wind Tunnel Tests; Adaptive Control; Walls

19970010822 NASA Langley Research Center, Hampton, VA USA

Simultaneous Luminescence Pressure and Temperature Measurement System for Hypersonic Wind Tunnels

Buck, Gregory M., NASA Langley Research Center, USA; Journal of Spacecraft and Rockets; Oct. 1995; Volume 32, No. 5, pp. 791-794; In English; 18th; Aerospace Ground Testing, 20-23 Jun. 1994, Colorado Springs, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA-TM-112159; NAS 1.15:112159; AIAA Paper 94-2482; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Surface pressures and temperatures are determined from visible emission brightness and green-to-red color ratioing of induced luminescence from a ceramic surface with an organic dye coating. A ceramic-dye matrix of porous silica ceramic with an adsorbed dye is developed for high-temperature pressure sensitivity and stability (up to 150 C). Induced luminescence may be excited using a broad range of incident radiation from visible blue light (488-nm wavelength) to the near ultraviolet (365 nm). Ceramic research models and test samples are fabricated using net-form slip-casting and sintering techniques. Methods of preparation and effects of adsorption film thickness on measurement sensitivity are discussed. With the present 8-bit imaging system a 10% pressure measurement uncertainty from 50 to 760 torr is estimated, with an improvement to 5% from 3 to 1500 torr with a 12-bit imaging system.

Author

Hypersonic Wind Tunnels; Surface Temperature; Pressure Measurement; Temperature Measurement; Photoluminescence

19970011014 Aeronautical Systems Div., 436 CES/CEF, Eglin AFB, FL USA

Elevating Aircraft Rescue Platform Product Evaluation Report ***Final Report, 14 Apr. 1995 - 5 Jan. 1996***

McSweemey, Kevin T., Military Aircraft Wing (346th), USA; Morris, Dave, Military Aircraft Wing (346th), USA; Kettie, Bob, Military Aircraft Wing (346th), USA; Kelley, Stephen E., Military Aircraft Wing (346th), USA; Feb. 12, 1996; 10p; In English; Original contains color plates

Report No.(s): AD-A310786; ASC-TR-96-1002; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Final report of the commercial technology exploitation evaluation of the Lift-A-Loft model MP25-15 Special elevating platform produced by Lift-A-Loft Corporation of Muncie, Indiana. The evaluation was conducted by the 436 CES, Fire Protection Division, Dover AFB, Delaware between 14 Apr 1995 and 5 Jan 1996. This evaluation was part of a continuing program to explore commercial off the shelf technology for application to Air Force firefighting requirements. The Lift-A-Loft model MP25-15 is a battery powered hydraulically activated scissor lift platform that can be towed, using a pintle hook equipped vehicle, to an aircraft and positioned to provide access up to 25 feet 3 inches above ground level. When the platform, with two firefighters aboard, was raised above 18 feet, it began to sway from side to side 8 to 10 inches off center. The 436th Wing Safety Office terminated the evaluation for stability and safety concerns. Investigation for a safer reasonably priced vehicle will continue for flightline firefighting/rescue capability on large frame aircraft.

DTIC

Aircraft Equipment; Rescue Operations; Fire Fighting; Flying Platforms

19970011086 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Human Factors Research Inst., Soesterberg, Netherlands

Validation of military target representation in a simulator through conspicuity ***Final Report*** ***Validatie van militaire doelweergave in een simulator d.m.v. opvallendheid***

Toet, A., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; DeVries, S. C., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Bijl, P., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Kooi, F. L., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Dec. 18, 1996; 45p; In Dutch

Contract(s)/Grant(s): A96/KL/342

Report No.(s): TM-96-AO61; TD-96-0503; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, Postbus 23, 3769 De Soesterberg), Hardcopy, Microfiche

The capability of visual conspicuity to evaluate the quality of representation of military targets in a simulator to be used for training in search and detection, is investigated. The visual conspicuity of target vehicles is determined for a number of lighting conditions, background structures, angular dimensions of the field of view, and velocities of the vehicles. The field measurements are duplicated on imagery generated by the ESIG-2000 simulator.

Derived from text

Target Simulators; Target Acquisition; Display Devices

19970011169 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Human Factors Research Inst., Soesterberg, Netherlands

Human Factors of Training in Virtual Environments ***Final Report*** ***Technisch Menskundige Aspecten van Virtuele Omgevingen voor Training***

Werkhoven, P. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Mooij, A. J. M., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Riemersma, J. B. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Lotens, W. A., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Nether-

lands; Jan. 10, 1997; 50p; In Dutch
Contract(s)/Grant(s): A95/KL/839
Report No.(s): TM-97-A002; TD-97-0509; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, Postbus 23, 3769 De Soesterberg), Hardcopy, Microfiche

The use of Virtual Environments (VE) for training is described. Advantages of VE and constraints associated with using VE are outlined.

Derived from text

Virtual Reality; Human-Computer Interface; Human Factors Engineering

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19970010492 Fokker Space and Systems, Leiden Netherlands

Performance Analysis of Dual-Mode Scramjet Propulsion Systems for Single-Stage-to-Orbit Space Transports in the Range of Flight Mach Numbers between 3.8 and 13

Kremer, Frans G. J., Fokker Space and Systems, Netherlands; Winterfeld, Gert, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Deutsche Forschungsanstalt fur Luft- und Raumfahrt e.V.; Nov. 1996; 174p; Transl. into ENGLISH of Leistungsanalyse von Dual-Mode-Scramjet-Antrieben fuer einstufige Raumtransporter im Bereich der Flugmachzahlen von 3,8 bis 13 (Cologne, Germany, DLR) 16 Jan. 1996 p 1-124; In English

Report No.(s): ESA-TT-1343; DLR-FB-95-47; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The performance characteristics of a dual mode scramjet propulsion system were analyzed. A 2D engine model was developed and combined with a 2D aerodynamic model. The influence of the important thermodynamic and geometric quantities on the performance of the scramjet propulsion system under the design conditions are described. An analysis of the limits of operation that these propulsion systems are subjected to is presented. For the estimation of the flight performance, the engine design parameters were specified for a design Mach number of 13. On this basis, the total fuel consumption for the scramjet-driven flight between flight Mach numbers of 7 to 13 is estimated. The performance characteristics of the ram mode were analyzed. The change from ram mode to scram mode is discussed.

Author (ESA)

Supersonic Combustion Ramjet Engines; Performance Prediction; Hypersonic Flight; Flight Characteristics; Aerodynamic Characteristics

19970010607 NASA Langley Research Center, Hampton, VA USA

Wake Flow About the Mars Pathfinder Entry Vehicle

Mitcheltree, R. A., NASA Langley Research Center, USA; Gnoffo, P. A., NASA Langley Research Center, USA; Jouranl of Spacecraft and Rockets; Sep. 1995; Volume 32, No. 5, pp. 770-776; In English; Thermophysics and Heat Transfer, 20-23 Jun. 1994, Colorado Springs, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA-TM-112158; NAS 1.15:112158; AIAA Paper 94-1958; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A computational approach is used to describe the aerothermodynamics of the Mars Pathfinder vehicle entering the Mars atmosphere at the maximum heating and maximum deceleration points in its trajectory. Ablating and nonablating boundary conditions are developed which produce maximum recombination of CO2 on the surface. For the maximum heating trajectory point, an axisymmetric, nonablating calculation predicts a stagnation-point value for the convective heating of 115 W/cm(exp 2). Radiative heating estimates predict an additional 5-12 W/cm(exp 2) at the stagnation point. Peak convective heating on the afterbody occurs on the vehicle’s flat stern with a value of 5.9% of the stagnation value. The forebody flow exhibits chemical nonequilibrium behavior, and the flow is frozen in the near wake. Including ablation injection on the forebody lowers the stagnation-point convective heating 18%.

Author

Mars Pathfinder; Aerothermodynamics; Atmospheric Entry; Mars Atmosphere; Convective Heat Transfer; Stagnation Point; Wakes; Flow Distribution; Computational Grids; Upwind Schemes (Mathematics)

19970011060 NASA Langley Research Center, Hampton, VA USA

Aerothermodynamic Measurement and Prediction for Modified Orbiter at Mach 6 and 10

Micol, John R., NASA Langley Research Center, USA; Journal of Spacecraft and Rockets; Oct. 1995; Volume 32, No. 5, pp. 737-748; In English; 26th; Thermophysics Conference, 24-27 Jun. 1991, Honolulu, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): NASA-TM-112157; NAS 1.15:112157; AIAA Paper 91-1436; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Detailed heat-transfer rate distributions measured laterally over the windward surface of an orbiter-like configuration using thin-film resistance heat-transfer gauges and globally using the newly developed relative intensity, two-color thermographic phosphor technique are presented for Mach 6 and 10 in air. The angle of attack was varied from 0 to 40 deg, and the freestream Reynolds number based on the model length was varied from 4 x 10(exp 5) to 6 x 10(exp 6) at Mach 6, corresponding to laminar, transitional, and turbulent boundary layers; the Reynolds number at Mach 10 was 4 x 10(exp 5), corresponding to laminar flow. The primary objective of the present study was to provide detailed benchmark heat-transfer data for the calibration of computational fluid-dynamics codes. Predictions from a Navier-Stokes solver referred to as the Langley aerothermodynamic upwind relaxation algorithm and an approximate boundary-layer solving method known as the axisymmetric analog three-dimensional boundary layer code are compared with measurement. In general, predicted laminar heat-transfer rates are in good agreement with measurements.

Author

Aerothermodynamics; Mach Number; Wind Tunnel Tests; Angle of Attack; Heat Transfer; Reynolds Number; Heat Measurement; Aerodynamic Configurations

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19970010381 NASA Lewis Research Center, Cleveland, OH USA

Probabilistic Assessment of National Wind Tunnel

Shah, A. R., NYMA, Inc., USA; Shiao, M., NYMA, Inc., USA; Chamis, C. C., NASA Lewis Research Center, USA; Nov. 1996; 26p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS3-27186; RTOP 505-63-5B

Report No.(s): NASA-TM-107296; E-10374; NAS 1.15:107296; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A preliminary probabilistic structural assessment of the critical section of National Wind Tunnel (NWT) is performed using NESSUS (Numerical Evaluation of Stochastic Structures Under Stress) computer code. Thereby, the capabilities of NESSUS code have been demonstrated to address reliability issues of the NWT. Uncertainties in the geometry, material properties, loads and stiffener location on the NWT are considered to perform the reliability assessment. Probabilistic stress, frequency, buckling, fatigue and proof load analyses are performed. These analyses cover the major global and some local design requirements. Based on the assumed uncertainties, the results reveal the assurance of minimum 0.999 reliability for the NWT. Preliminary life prediction analysis results show that the life of the NWT is governed by the fatigue of welds. Also, reliability based proof test assessment is performed.

Author

Probability Distribution Functions; Buckling; Metal Fatigue; Fatigue Life; Wind Tunnels; Computer Programs; Finite Element Method; Structural Analysis

19970010467 NASA Ames Research Center, Moffett Field, CA USA

Further Developments of the Fringe-Imaging Skin Friction Technique

Zilliac, Gregory C., NASA Ames Research Center, USA; Dec. 1996; 40p; In English

Contract(s)/Grant(s): RTOP 505-59-54

Report No.(s): NASA-TM-110425; A-965314; NAS 1.26:110425; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Various aspects and extensions of the Fringe-Imaging Skin Friction technique (FISF) have been explored through the use of several benchtop experiments and modeling. The technique has been extended to handle three-dimensional flow fields with mild shear gradients. The optical and imaging system has been refined and a PC-based application has been written that has made it possible to obtain high resolution skin friction field measurements in a reasonable period of time. The improved method was tested

on a wingtip and compared with Navier-Stokes computations. Additionally, a general approach to interferogram-fringe spacing analysis has been developed that should have applications in other areas of interferometry. A detailed error analysis of the FISF technique is also included.
Author
Skin Friction; Flow Distribution; Three Dimensional Flow; Navier-Stokes Equation; Diffraction Patterns; Wing Tips; Imaging Techniques

19970010482 Omega Technical Services, Milton, WA USA
Improved Cabin Smoke Control ***Final Report***
Porter, Allen, Omega Technical Services, USA; May 1996; 58p; In English
Contract(s)/Grant(s): DTS57-93-C-00125
Report No.(s): AD-A309853; DOT/FAA/AR-96/23; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The major features and performance parameters of the Boeing 757 cabin ventilation system are described within the context of cabin smoke control. Two design changes were developed and evaluated. In the first design, additional ventilation outflow valves are located on the upper part of the fuselage and cabin ventilation is modified to provide air delivery in either the front or rear half of the fuselage. The second proposed design involves establishing the capability of reversing the ventilation flow so that it enters at the cabin floor and exits into the ceiling air distribution ducts. The technical feasibility of the design changes was assessed through installation complexity, added weight, and estimated effectiveness. Elements requiring further study were also identified.
DTIC
Feasibility Analysis; Aircraft Compartments

19970010484 Allison Engine Co., Indianapolis, IN USA
Aeropropulsion Technology (APT). Task 23 - Stator Seal Cavity Flow Investigation ***Final Report***
Heidegger, N. J., Allison Engine Co., USA; Hall, E. J., Allison Engine Co., USA; Delaney, R. A., Allison Engine Co., USA; Dec. 1996; 148p; In English
Contract(s)/Grant(s): NAS3-25950; RTOP 509-10-11
Report No.(s): NASA-CR-198504; E-10340; NAS 1.26:198504; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The focus of NASA Contract NAS3-25950 Task 23 was to numerically investigate the flow through an axial compressor inner-banded stator seal cavity. The Allison/NASA developed ADPAC code was used to obtain all flow predictions. Flow through a labyrinth stator seal cavity of a high-speed compressor was modeled by coupling the cavity flow path and the main flow path of the compressor. A grid resolution study was performed to guarantee adequate grid spacing was used. Both unsteady rotor-stator-rotor interactions and steady-state isolated blade calculations were performed with and without the seal cavity present. A parameterized seal cavity study of the high-speed stator seal cavity collected a series of solutions for geometric variations. The parameter list included seal tooth gap, cavity depth, wheel speed, radial mismatch of hub flowpath, axial trench gap, hub corner treatments, and land edge treatments. Solution data presented includes radial and pitchwise distributions of flow variables and particle traces describing the flow character.
Author
Labyrinth Seals; Turbocompressors; Cavity Flow; Flow Distribution; Computational Fluid Dynamics; Navier-Stokes Equation; Aircraft Engines; Stator Blades; Grid Generation (Mathematics)

19970010510 Naval Postgraduate School, Monterey, CA USA
Propagation Loss Study and Antenna Design for the Micro-Remotely Powered Vehicle (MRPV)
Gibson, Thad B., Naval Postgraduate School, USA; Sep. 1995; 116p; In English
Report No.(s): AD-A309164; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis presents a propagation study and antenna design for the Micro-Remotely Powered Vehicle (MRPV). A propagation loss study was conducted to determine the attenuation of various building walls and to select an optimum frequency band for antenna design. An approximate ray tracing model for loss determination was developed and programmed in MATLAB. The computed losses from the model are presented for comparison with measured results. One possible antenna configuration for the MRPV, a circumferential slot, is analyzed and design parameters varied to obtain optimum antenna gain. A prototype of the slot antenna was developed. The antenna patterns, efficiency, and Voltage Standing Wave Ratio (VSWR) are presented.
DTIC
Slot Antennas; Antenna Design; Transmission Loss; Microwave Power Beaming; Helicopters; Microwave Attenuation

13
GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19970010498 Wyle Labs., Inc., El Segundo, CA USA

Feasibility Analysis of a NOISEMAP Calculation Procedure for Helicopter and VTOL Aircraft Noise Exposure, *May 1993 - Feb. 1994*

Brown, D., Wyle Labs., Inc., USA; Boulton, C. L., Wyle Labs., Inc., USA; Jun. 1996; 26p; In English

Contract(s)/Grant(s): AF Proj. 7757

Report No.(s): AD-A310795; WR94-3; AL/OE-TR-1996-0088; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current NOISEMAP programs, including BASEOPS, Master Control Module (MCM), OMEGA 10 and 11 and NOISEMAP/NOISEFILE, are tailored to be applicable to fixed-wing aircraft operations and corresponding maintenance run-ups at airbases with runways. The programs can be and have been used for helicopter operations but are not well suited to this use in their present form. It is recommended that NOISEMAP be adapted to include an optional selection of helicopter applicability, the results of which can be noise contour plotted as a stand-alone case or in conjunction ('energy-added') with other fixed-wing aircraft cases. It is recommended that the NOISEMAP development be performed in two phases: Phase 1 would include revisions to BASEOPS, MCM and NOISEMAP to allow current NOISEFILE helicopter data to be better and most conveniently utilized for assembling and running helicopter operational cases. These revisions would include assembling a standardized set of helicopter operating conditions for which SEL versus distance files can be generated by OMEGA 10 and 11 by reference to the existing NOISEFILE data. Phase 2 would be an upgrade to the Phase 1 program to include refinements specific to helicopter noise, such as in-flight directivity effects, modified lateral attenuation models, an enhanced database for additional power/flight conditions (to replace surrogate files) and an increased compatibility with the DOT/FAA Heliport Noise Model.

DTIC

Aircraft Noise; Noise Prediction (Aircraft); Computer Programs; Helicopters; Heliports; Noise Intensity; Vertical Takeoff Aircraft

19970010608 Wisconsin Univ., Cooperative Inst. for Meteorological Satellite Studies, Madison, WI USA

Development of a Microburst Risk Image Product Derived from Satellite Sounder Data

Nelson, James P., III, Wisconsin Univ., USA; Ellrod, Gary P., National Oceanic and Atmospheric Administration, USA; Conference on Aviation Weather Sytems; Jan. 20, 1995, pp. 89-94; In English; 6th; Aviation Weather Systems, 15-20 Jan. 1995, Dallas, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

It has been well documented over the past two decades that numerous accidents involving air travel have been caused by microbursts, a meteorological phenomenon consisting of a strong downrush of air below cloud base, then outrush of air upon ground contact, that can originate either from thunderstorms or more innocuous cumulonimbi with cloud bases well above ground. Given that microbursts pose such a severe threat to air travel, the ability to outline regions where these phenomena are likely to occur is of great benefit to the aviation community. Two types of microbursts have been identified in the literature: wet microbursts and dry microbursts. The atmosphere in the vicinity of each type of microburst has a distinctive vertical structure of both temperature and moisture, from which several parameters that forewarn of potential microburst occurrence (i.e., microburst risk) can be determined. Vertical profiles of temperature and moisture derived from geostationary satellite radiance measurements can provide information about these structures. After microburst risk parameters have been computed for a given region, it is necessary to decide what means of display of the parameters is best for operational use. We suggest that using imagery derived from the predictors is the best approach, allowing for a clearer and more informative presentation of the region(s) where a risk of microbursts exists. This paper will focus on microburst risk imagery derived from GOES-7 retrievals of temperature and moisture near the time of the 2 August 1985 Delta Flight 191 crash at Dallas-Ft. Worth International Airport (DFW).

Author

Atmospheric Circulation; Aircraft Accidents; Aircraft Safety; Satellite Observation; Satellite Imagery

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19970010861 Army Aeromedical Research Lab., Aircrew Protection Div., Fort Rucker, AL USA

Aviation Life Support Equipment Retrieval Program: Report of Aircraft Mishap 95-4, Involving the HGU-56/P Army Aviation Helmet ***Final Report***

Voisine, Joel J., Army Aeromedical Research Lab., USA; Licina, Joseph R., Army Aeromedical Research Lab., USA; McEntire, B. J., Army Aeromedical Research Lab., USA; Albano, John P., Army Aeromedical Research Lab., USA; Mar. 1996; 12p; In English

Contract(s)/Grant(s): DA Proj. 3O1-62787-A8-78

Report No.(s): AD-A309175; USAARL-96-22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1972, the U.S. Army Aeromedical Research Laboratory (USAARL) established the Aviation Life Support Equipment Retrieval Program (ALSERP). The purpose of this program is to evaluate the effectiveness of aviation protective equipment in an aircraft accident environment and to contribute to the improvement of this equipment through modification or development of new design criteria. Department of the Army Pamphlet 385-40, Army Accident Investigation and Reporting, requires all life support equipment which is in any way implicated in the cause or prevention of injury be shipped to USAARL for analysis. This report analyzes the first impact damaged HGU-56/P recovered from a recent Army aviation mishap involving an AH-6J helicopter.

DTIC

Life Support Systems; Aerospace Medicine; Aircraft Accidents; Helicopters; Helmets; Injuries

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19970010671 FAIR Information Services, Amsterdam, Netherlands

A Multidisciplinary Approach in Computer Aided Engineering

Laan, D. J., FAIR Information Services, Netherlands; Oct. 1996; 10p; In English; Also announced as 19970010666; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Computer Aided Engineering (CAE) has a long history within Fokker. Already in 1955, the FERTA-computer (Fokkers Eerste Rekenapparaat Type Arra) was used for aeroelastic analysis of the F27. Many disciplines automated their design methods in the sixties and seventies. The resulting islands of automation started to be recognized as a problem only afterwards. Fokker Aircraft come to a point where significant progress could only be achieved by integrating the various disciplines and their CAE-models. These models should be applied in support of a properly design process. Therefore, the CAE-project was started in 1994. During this project a transition was made from 'each specialist building his own CAE-model' towards teamwork in building multi-disciplinary CAE-models. This will be illustrated by a number of examples from such areas as weight and balance, flight dynamics and structural design and optimization. Finally, a view on future developments is presented, building on the historical perspective of CAE developments at Fokker Aircraft.

Author

Computer Aided Design; Multidisciplinary Design Optimization; Fokker Aircraft; Aircraft Design

16
PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19970010460 NASA Langley Research Center, Hampton, VA USA

Comparisons of Methods for Predicting Community Annoyance Due to Sonic Booms

Hubbard, Harvey H., NASA Langley Research Center, USA; Shepherd, Kevin P., NASA Langley Research Center, USA; Nov. 1996; 38p; In English

Contract(s)/Grant(s): RTOP 537-09-21-04
Report No.(s): NASA-TM-110289; NAS 1.15:110289; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two approaches to the prediction of community response to sonic boom exposure are examined and compared. The first approach is based on the wealth of data concerning community response to common transportation noises coupled with results of a sonic boom/aircraft noise comparison study. The second approach is based on limited field studies of community response to sonic booms. Substantial differences between indoor and outdoor listening conditions are observed. Reasonable agreement is observed between predicted community responses and available measured responses.
Author
Sonic Booms; Jet Aircraft Noise; Exposure; Human Reactions; Human Tolerances

19970010850 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
New Computational Methods for the Prediction and Analysis of Helicopter Noise
Strawn, Roger C., NASA Ames Research Center, USA; Oliker, Leonid, Research Inst. for Advanced Computer Science, USA; Biswas Rupak, Research Inst. for Advanced Computer Science, USA; May 1995; 14p; In English; 2nd; Aeroacoustics Conference, 6-8 May 1996, State College, PA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS2-13721
Report No.(s): NASA-CR-203274; NAS 1.26:203274; RIACS-TR-96-10; AIAA Paper 96-1696; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes several new methods to predict and analyze rotorcraft noise. These methods are: (1) a combined computational fluid dynamics and Kirchhoff scheme for far-field noise predictions; (2) parallel computer implementation of the Kirchhoff integrations; (3) audio and visual rendering of the computed acoustic predictions over large far-field regions; and (4) acoustic tracebacks to the Kirchhoff surface to pinpoint the sources of the rotor noise. The paper describes each method and presents sample results for three test cases. The first case consists of in-plane high-speed impulsive noise and the other two cases show idealized parallel and oblique blade-vortex interactions. The computed results show good agreement with available experimental data but convey much more information about the far-field noise propagation. When taken together, these new analysis methods exploit the power of new computer technologies and offer the potential to significantly improve our prediction and understanding of rotorcraft noise.
Author
Aircraft Noise; Rotary Wing Aircraft; Parallel Computers; Blade-Vortex Interaction; Noise Propagation; Computational Fluid Dynamics; Noise Prediction (Aircraft)

19970011091 Florida State Univ., Dept. of Mathematics, Tallahassee, FL USA
On the Two Components of Turbulent Mixing Noise from Supersonic Jets
Tam, Christopher K. W., Florida State Univ., USA; Golebiowski, Michel, Florida State Univ., USA; Seiner, J. M., NASA Langley Research Center, USA; 1996; 18p; In English; 2nd; Aeroacoustics, 6-8 May 1996, State College, PA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-1776
Report No.(s): NASA-CR-202816; AIAA Paper 96-1716; NAS 1.26:202816; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

It is argued that because of the lack of intrinsic length and time scales in the core part of the jet flow, the radiated noise spectrum of a high-speed jet should exhibit similarity. A careful analysis of all the axisymmetric supersonic jet noise spectra in the data-bank of the Jet Noise Laboratory of the NASA Langley Research Center has been carried out. Two similarity spectra, one for the noise from the large turbulence structures/instability waves of the jet flow, the other for the noise from the fine-scale turbulence, are identified. The two similarity spectra appear to be universal spectra for axisymmetric jets. They fit all the measured data including those from subsonic jets. Experimental evidence are presented showing that regardless of whether a jet is supersonic or subsonic the noise characteristics and generation mechanisms are the same. There is large turbulence structures/instability waves noise from subsonic jets. This noise component can be seen prominently inside the cone of silence of the fine-scale turbulence noise near the jet axis. For imperfectly expanded supersonic jets, a shock cell structure is formed inside the jet plume. Measured spectra are provided to demonstrate that the presence of a shock cell structure has little effect on the radiated turbulent mixing noise. The shape of the noise spectrum as well as the noise intensity remain practically the same as those of a fully expanded jet. However, for jets undergoing strong screeching, there is broadband noise amplification for both turbulent mixing noise components. It is discovered through a pilot study of the noise spectrum of rectangular and elliptic supersonic jets that the turbulent mixing noise

of these jets is also made up of the same two noise components found in axisymmetric jets. The spectrum of each individual noise component also fits the corresponding similarity spectrum of axisymmetric jets.
Author
Turbulent Mixing; Supersonic Jet Flow; Noise Spectra; Noise Measurement; Jet Aircraft Noise

17
SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19970010738 Air Force Occupational Measurement Center, Randolph AFB, TX USA
Avionics Sensors Maintenance, AFSC 2A1X1
Jun. 1996; 68p; In English
Report No.(s): AD-A310760; AFPT-90-2A1-049; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This is a report of an occupational survey of the Avionic Sensors Maintenance career ladder conducted by the Occupational Analysis Flight, Air Force Occupational Measurement Squadron. The survey was conducted to obtain current job and task data. Data collected through this OSR will be utilized by training development personnel to review courses and related training documents in light of equipment and utilization changes which have occurred since the last OSR in 1990.
DTIC
Avionics; Training Analysis; Personnel Development; Maintenance Training

Subject Term Index

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Report Documentation Page

1. Report No. NASA SP-7037 (345)	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Aeronautical Engineering A Continuing Bibliography (Supplement 345)		5. Report Date April 4, 1997 6. Performing Organization Code
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